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THE CANCER PROBLEM OF THE FEMALE BREAST. AN ANALYSIS BASED UPON 25 YEARS PERSONAL EXPERIENCE WITH RADIATION THERAPY

by

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Read by Title at the 4th Meeting of the Northern Association for Medical Radiology in Helsingfors, September 1st and 2nd 1925.

For a great many years, American newspapers carried the gruesome advertisement of a notorious cancer quack, showing the picture of an object resembling a distorted crab with tenacles and the significant words, "Any lump in woman's breast is cancer". Another caption stated that he "did not use surgery, roentgen rays or any other swindle". While medical men combatted this monstrous fraud with righteous indignation, the pertinent fact remains that the quack is practically correct in his statement concerning the lump, when by "lump", we mean new growth and not simple cysts, adenomata or infections. A transient mastitis is not cancer, neither is it a new growth, yet how frequently has not a mastitis been removed surgically or destroyed by paste, cautery or even by radiation, and the result claimed as a cancer cure? It is not the intention of this article to detract one iota from the brilliant and up to the present time, incomparable work of surgery in cancer, but when we single out cancer of the breast, we are upon the most debatable ground in the whole sphere of medical procedure. I am glad to yield to surgery the point that complete cure follows the successful removal of all the tissue which may be involved in the cancer process, and to recommend surgery above any other procedure in all cases where this fact can be assured. Yet is it not true that a great many cancer patients apparently successfully operated upon under this assumption have recurrences or implantation sequelae in almost as high a percentage as in those cases already metastasized and operated

upon? While presenting this rather pessimistic view, I desire to state clearly that it is not my intention to carry the thought that we, as radiologists, can claim better results with our energy of radiation, but if we review past experiences and consider the fact that radiology is a comparatively young science, may we not hope to expect a brighter clinical picture for cancer sufferers in the near future? I have several times before uttered the belief that any form of radiation therapy with which we are at the present time conversant, cannot be looked upon as a cure for cancer, although it can no longer be denied that radiation therapy has exercised a curative influence over certain types of cancer greater than that of any other single or of all combined treatment agencies heretofore employed.

At a recent conference on breast cancer between three eminent scientists, one a surgeon, the other a pathologist and the third a radiologist, the discussion was closed by the pathologist to the effect that surgery was not curative, neither was radiology but that the patient had a better outlook for a longer and more comfortable life period with conservative radiation treatments. This is a significant statement and bears out our observations. It will not be necessary to go into the details of our early treatment efforts with crude appliances — you have all had personal experiences. Suffice it to say that we have ample grounds to feel somewhat optimistic and by an interchange of opinions and a frank discussion of our failures as well as successes, we may reach a maximum of humanitarium service, an end toward which we all are striving. The study of endocrinology may add to our understanding of cancer but in the absence of established facts, we are compelled to apply our knowledge of radiation therapy with the conviction that we are on proven, if somewhat insecure ground.

In the light of our modern day knowledge of cancer, what shall we say to the woman who comes to us with cancer of the breast? Formerly a patient with a primary isolated nodule in the breast, I would immediately refer to a surgeon. Today, with due regard to my earlier surgical training, I would urge upon such a patient a consistent course of radiation treatment. In the event the growth was benign, the radiation would save the patient from any mutilation and would yield a symptomatic cure. If the nodule were malignant, the treatment would at least do no harm and would enhance the curative value of subsequent surgical intervention. When, on the other hand, we are dealing with an ulcerating or multiple cancer of the breast with palpable axillary nodes, we have a much more serious matter to consider. While such cases are poor surgical risks and are even refused operation by some very excellent surgeons, I

have reason to believe that we can augment the curative cases by a combined procedure about as follows: The entire chest, back and axilla are exposed to a tolerance or deep erythema roentgen dose. The surgeon then removes the breast and remaining glands with the cautery knife preferably. In such case, immediate post-operative radiation should not be undertaken, at least not until complete tissue repair has occurred. It has always been my belief that the full preoperative dose was of more value than one following the operation, and personal observation over a long period of time seems to substantiate this, although I am still in favour of substantial post-operative radiation treatment. Of course, if metastatic growth reappears, we are in duty bound to apply further radiation up to the limit of tolerance.

In February of 1902, before the Los Angeles County Medical Society, I had the privilege of reporting my first case of carcinoma of the breast treated by Roentgen rays. This is recorded in the April 1902 issue of the Southern California Practitioner and concerns a metastasized cancer involving the left breast. Singularly enough the condition cleared up even with the unstable roentgen apparatus and accessories in use at that time and the patient remained well for a number of years before she moved away and was lost track of.

I desire to quote the last paragraph in the article alluded to if only for the sake of stating that the thoughts expressed have in no way been modified by the twenty-three intervening years since their utterance. The paragraph follows:

> "There is no contra-indication to the proper use of X-rays in any stage of carcinoma; even when used in hopelessly advanced cases, they will relieve the pain and lessen the discharge in a more satisfactory manner than any other therapeutic agent with which we are familiar."

Now comes that great class of poor unfortunates with whom we have our daily heartrending experiences. What shall we do with the large ulcerating massive types with extensive infiltration and metastasis in every direction, with large edematous and useless arms, with emaciation and with odors that are sickening? So long as the law forbids the medical profession placing these poor hopeless unfortunates at a painless, merciful and eternal rest, we are morally obliged to use the few means at our command to assuage the suffering. With morphine and intensive radiation, we can accomplish little more than temporary palliation, but in our very helplessness we must submit to these. While available medical statistics are in the main unsatisfactory, this applies forcibly to cancer of the breast. It is difficult to maintain a follow-up system that will yield more than fragmentary information. I have, however, classified those cases

in my own service of which we have a definite time period of observation into two groups of two divisions each and this tabulation is respectfully submitted for your inspection and comment.

SUMMARY OF 550 CASES OF MAMMARY NEOPLASMS TREATED, 1915—1923

Group I (Radiation Only)

A) Early primary cases, without metastasis.
B) Late, extensive or inoperable cases, with metastasis.

Group II (Radiation & Surgery)

A) Early primary cases, radiated in conjunction with surgery.
B) Cases recurring after surgery.

Group I (Radiation Only)

A) Early, No Metastasis, 64 Cases.

1. Movable lumps which disappeared. 22.
   Time elapsed:
   1—2 years, 10 cases.
   2—3 years, 4 cases.
   3—4 years, 8 cases.
2. Adherent lumps, no benefit from radiation, operation refused, death ensuing. 10.
3. Adherent lumps, recovery. 26.
   Time elapsed:
   1—2 years, 8 cases. 3—4 years, 2 cases.
   2—3 years, 10 cases. 4—5 years, 6 cases.
4. Movable lumps, no improvement. 4.

Note: At later operation, one growth proved malignant, and three benign. The possibility of an arrested primary malignancy should not be overlooked.

5. Cases not traced. 2.

B) Late, With Metastasis, 110 Cases.

1. Cases not living. 32.
(Average time of survival, 14 mos.)
2. Cases living but showing pathology. 24.
   Time elapsed:
   1—2 years, 12 cases. 3—4 years, 2 cases.
   2—3 years, 8 cases. 4—5 years, 2 cases.
(Average time under observation, 16 mos.)
3. Cases entirely well. 6.
   Time elapsed:
   1—2 years, 2 cases.
   2—3 years, 2 cases.
   4—6 years, 2 cases.
4. No improvement. 12.
5. Not traced. 36.

Note: Lung metastasis was present in 6 cases.

Group II (Radiation & Surgery)

A) Early, radiated in conjunction with Surgery 158 Cases.

1. Recurrences, status unknown. 10.
2. No recurrence. 148.
   Time elapsed:
   1—2 years, 19 cases. 5—6 years, 30 cases.
   2—3 years, 27 cases. 6—7 years, 11 cases.
   3—4 years, 20 cases. 7—8 years, 3 cases.
   4—5 years, 37 cases. 8—9 years, 1 case.

(Average time since treatment, 3 yrs. 7 mos.)

Note: With reference to the 148 without recurrence: There was no demonstrable pathology when patients were last seen.

B) Late, Extensive and Recurrent Cases 218 Cases.

1. Cases not living. 82.

(Average time under observation, 17 mos.)

2. Cases living, unimproved. 32.
3. Cases living, improved, but showing pathology. 22.
   Time elapsed:
   1—2 years, 6 cases. 4—5 years, 2 cases.
   2—3 years, 8 cases. 5—6 years, 1 case.
   3—4 years, 4 cases.
4. Cases showing pathology. 60.
   Time elapsed:
   1—2 years, 8 cases. 4—5 years, 2 cases.
   2—3 years, 26 cases. 5—6 years, 12 cases.
   3—4 years, 8 cases. 6—7 years, 4 cases.
5. Cases not traced. 22.

Note: 1) Average time of recurrence in cases previously operated was 14 months. 2) Of this series, 48 cases showed lung involvement on admission. 3) 26 cases were radiated immediately after operation, but recurred later.

SUMMARY. 1) Cancer of the breast, when recognized as such, is a surgical dilemma, which very frequently taxes the judgment of the skilled clinician.

2) In primary localized cancer of the breast, surgery is the best remedy, yet radiation's present claims must be given respectful consideration.

3) In other types of breast cancer, radiation is rapidly assuming first position, with surgery as a close synergist in selected cases.

4) The present high level of surgical achievement follows centuries of application and experience. Therefore, it is difficult to visualize any immediate change in results from this source.

5) Radiation is scarcely thirty-five years old, and it is certainly reasonable to expect rapid and definite advance in this science, admitting that our knowledge of its possibilities is exceedingly limited.

6) In our present helplessness to stop the ravages and intense suffering of advanced cancer, it is not unreasonable to demand laws, which will give to properly authorized institutions the humane right to give such cancer sufferers merciful and eternal peace.

7) The attached summary of cases has been carefully prepared from our records, and we believe it to be correct.

ZUSAMMENFASSUNG. 1) Brustcancer, wenn als solcher erkannt, bedeutet für den Chirurgen eine grosse Schwierigkeit, die sehr oft die Beurteilung des geschickten Klinikers auf eine harte Probe stellt.

2) Für früh genug lokalisierten Brustcancer ist Operation das beste Heilmittel; die jetzigen Möglichkeiten der Radiotherapie dürfen aber nicht ausser Acht gelassen werden.

3) In anderen Fällen von Brustcancer nimmt die Radiotherapie immer mehr die erste Stelle ein, in einzelnen Fällen mit der Chirurgie als wichtigem Hilfsmittel.

4) Der jetzige hohe Stand der chirurgischen Leistungen ist das Resultat der Forschungen und Erfahrungen von Jahrhunderten, weshalb man kaum irgend eine baldige Veränderung der Resultate von dieser Seite voraussehen kann.

5) Die Radiotherapie ist kaum 35 Jahre alt und man ist gewiss berechtigt, schnelle und bestimmte Fortschritte in dieser Wissenschaft zu erwarten, in Anbetracht dessen, dass unsere Kenntnisse betreffs ihrer Möglichkeiten sehr beschränkt sind.

6) In unserer gegenwärtigen Hilfslosigkeit, die Verheerungen und die entsetzlichen Leiden des fortgeschrittenen Cancers hemmen zu können, ist es nicht unberechtigt, Gesetze zu verlangen, die besonders autorisierten Institutionen das humane Recht geben würden, solchen Cancerleidenden barmherzige und ewige Ruhe zu schenken.

7) Die beigefügte Sammlung von Fällen ist aus unserer Krankenstatistik sehr sorgfältig zusammengestellt worden und ist, wie wir hoffen, korrekt.

RÉSUMÉ. 1) Le cancer mammaire, dûment diagnostiqué, constitue un problème chirurgical qui met fréquemment à l'épreuve le jugement des cliniciens éminents.

2) Dans la localisation primaire du cancer mammaire, l'intervention chirurgicale reste la méthode de choix, encore qu'il convienne de prendre en sérieuse considération les droits actuels de la radiothérapie.

3) Dans les autres formes de cancer du sein, la radiothérapie est appelée à prendre une rapide prépondérance, en collaboration intime, dans certains cas, avec la chirurgie.

4) Le niveau atteint actuellement par les méthodes chirurgicales est le fruit de plusieurs siècles de pratique et d'études. Aussi ne peut-on s'attendre à une modification immédiate des résultats de cette méthode.

5) La radiothérapie date à peine de 35 ans et on est certainement en droit d'attendre de cette science des progrès rapides et précis, si l'on songe surtout combien peu nous en connaissons encore les ressources.

6) Dans notre impuissance actuelle vis à vis des ravages du cancer avancé et des souffrances qu'il provoque, il ne paraît pas déraisonnable de demander le vote d'une loi qui donnerait à des institutions dûment autorisées le droit humain de délivrer à jamais les cancéreux de leurs souffrances.

7) Le résumé ci-joint des cas a été soigneusement établi d'après nos observations et nous espérons qu'il est correct.

THE ROENTGEN TREATMENT OF SURGICAL TUBERCULOSIS

by

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Introductory Address at the 4th Meeting of the Northern Association for Medical Radiology in Helsingfors, September 1st and 2nd 1925.

The Roentgen therapy of the so-called surgical tuberculosis became at quite an early period a subject of deep interest to the radiologists in the great civilized countries of Europe as well as in the United States, and already during the last 10 years before the outbreak of the great war several important and fundamental works upon this topic are to be recorded from different countries. Also during the war, and still more after it, has the Roentgen ray been more and more made use of in the treatment of this form of disease, especially in Germany where the great increase of tuberculosis has necessitated a summoning of all forces to fight against it. Although the experience as to the value of the Roentgen therapy in certain of these localizations of tuberculosis is now sufficiently established, the opinions about others still differ. This fact may have been the reason for the Roentgen treatment of surgical tuberculosis being taken up as a subject for discussion at this meeting.

It is now quite accepted in general medical knowledge that the forms of tuberculosis comprised under the term »surgical tuberculosis» are usually only local manifestations of a general tuberculous infection of the organism. The Roentgen therapy is, on the other hand, as well as the surgical, of a purely local nature and can, as far as our knowledge at present goes, only exert an influence limited to the localized changes as far as these are manifest to clinical examination. Therefore, in every treatment of these forms of tuberculosis, there ought to be included a general therapeutic influence, which is aimed at the patient in his entirety and which must generally be considered quite as important as the local one. To enter

more closely upon the nature and extent of this general treatment does not, however, fall within the range of this work.

On the Nature of the Roentgen Ray's Influence in Tuberculosis

All tuberculous affections of the body are to be ascribed to a local presence of tubercle-bacilli, which cause the well-known, specific changes of the tissues: partly the formation of tubercles, resp. tuberculous granulation tissue, partly the production of an exudate containing only few cells, with secondary necrosis and caseous transformation of the same and of the surrounding tissue. Thus we must imagine the therapeutic influence of the Roentgen ray as directed either against the bacilli themselves or against the specific granulation tissue or its surrounding region. As a third possibility an indirect general influence, a form of autotuberculinization, is hinted at.

The hope of having found a clinically available, *bactericidal* antituberculotic in the X-rays did not last long. Already BERGONIÉ and TEISSIER considered themselves in a position to eliminate this by their experiments with irradiation of inoculated guinea-pigs. Later on, KÜPFERLE and BACMEISTER came to the same result, and in irradiating cultures of bacilli in vitro HABERLAND and KLEIN found that doses of up to 3 H.E.D. have no perceivable influence upon them. RITTER's and MOJE's experimental investigations with inoculation of glandular tissue from infected and afterwards irradiated guinea-pigs point in the same direction. Nor can KRALL's discoveries of virulent, though weakened, bacilli in caseous lymphomata irradiated with therapeutic doses, be used as evidence of the radiosensibility of the bacilli.

Further it might be possible that the Roentgen rays could indirectly, by influence upon *surrounding tissues*, have a detrimental effect also upon the tubercle-bacilli themselves. As DE QURVAIN points out, such an influence would most likely be brought about by co-operation of the autolytical ferments set free at the decomposition of the tuberculous granulation tissue after irradiation. Several authors quote in this connection DEYKE's and MUCH's discovery that the tubercle-bacilli are dissolved by choline and neurine, substances which according to WERNER are formed out of lecithin under the influence of X-rays and thus, by their presence, really might be supposed to play a certain rôle in the above-mentioned respect. It remains to see if future investigations will corroborate this theory.

Concerning the *influence of the Roentgen ray upon the tuberculous granulation tissue* there are, however, more certain facts. Already HEINEKE has shown that the lymphoid tissue is highly radiosensitive

and reacts within a very short time by destruction of the nuclei and breaking down of the cells. Also the epitheloid constituents of the tissues are — according to the law of BERGONIÉ and TRIBONDEAU — highly sensitive to Roentgen irradiation whereat, according to PETERSEN, the giant cells show the greatest resistance. Whether this abundant destruction of cells is to be regarded as destroying the substrate of the tubercle-bacilli, according to the opinion of WETTERER, or as a disengagement of ferments dissolving the bacilli in accordance with the belief of DE QUERVAIN, is quite unknown to us. It is, however, indisputable that numbers of cells break down at the Roentgen irradiation, and in the first place lympho- and leucocytes. In this connection, JÜNGLING has rightly drawn attention to the fact that exactly those forms of tuberculosis, which present a particular abundance of such cells, e. g. the lymphomata, are most susceptible, whereas the epitheloid cell tuberculosis, e. g. the tuberculids and KIENBÖCK's »ostitis tuberculosa multiplex cystica», is much more resistant, and furthermore that the reason why cases with mixed infection show a high degree of radio-sensibility, is just to be found in their abundance of cells of the leucocyte group. BAISCH also found that the cellular elements broke down after irradiation of fistulous lymphomata and were missing in the fistulous secretion.

In connection with this cellular degeneration we must, however, also take into account a reactive new formation of tissues emanating from the connective tissue in the region surrounding the tuberculous foci. According to BAISCH this process can be seen already about fifteen days after the irradiation, when vessels are seen to grow into the necrotic foci where phagocytes and fibroblasts appear and at last a process of organization with secondary fibrous alteration takes place. This takes a long time, a fact that explains the usually protracted time of healing. Certain authors, as PETERSEN, BACMEISTER and KÜPFERLE, RITTER and MOJE, consider the essential effect of the Roentgen treatment to be an irritation of the elements of the connective tissue to such a positive action and base this opinion upon histological observations. JÜNGLING (and with him BAENSCH) looks upon this conception somewhat sceptically, since every healing process in tuberculosis is to be characterized as a cicatrization with sclerosis; whether the decomposition of cells or the proliferation of connective tissue is to be considered as the primary, is beyond our judgment. It is also difficult to tell whether this proliferation is to be viewed as directly caused by the irradiation or is first indirectly elicited by the breaking down products of the cells.

An entirely separate position as to the effect of Roentgen rays in

tuberculosis is taken up by STEPHAN. Having observed that results have become rather worse than better with the progress of the modern Roentgen technique, he ascribes this to an overdosage with reference to the epitheloid granulation tissue. He looks upon the latter as a defensive weapon of the organism against the tubercle-bacilli and attributes a strong phagocytic activity to it. The more favorable effect of the smaller doses previously in use he further explains as a direct irritating effect upon these cells to increased activity, and he therefore recommends irradiation with very small doses only (10 to 20 % of an H.E.D. at the highest). KOHLER goes still further and recommends for the same reason doses of only 3—5 % H.E.D. This entire view may be traced to the application of the so-called ARNDT-SCHULTZE's law on the irritative effect of small doses on the cells of the organism in practical Roentgen therapy. This standpoint has, especially in German literature, found many devoted advocates, but its authority has begun to be doubted of late years and has been emphatically contested by HOLZKNECHT and JÜNGLING among others. Nor has this theory received any support here in Sweden.

Finally, as to the theory of an »Entgiftung» (distoxication) of the body by the Roentgen ray, an autotuberculinization, this theory originates from ISELIN who, having found in some of his patients an increase in weight proceeding parallel with the breaking down of the tuberculous tissue, has tried to explain this as a general effect on the organism of antibodies formed in the blood at the decomposition and resorption of the caseous foci. This view, which for some time won the German literature's ready support (BAISCH, WILMS and others) can, however, not be considered sufficiently confirmed by the argument of ISELIN. PEYSER remarks rightly that loss of weight as well as increase very often appear during the Roentgen treatment, and that the latter may just as well be attributed to an (indirect) influence of the bacilli themselves, whereby their production of toxins might be reduced. At any rate ISELIN's opinion, as well as that of STEPHAN, must for the present be considered a mere theory.

Roentgen Treatment of Special Localizations of Tuberculosis

A. Tuberculous Lymphomata

The X-rays were, as is known, first used in U. S. A. in tuberculous lymphomata (WILLIAMS 1902, afterwards int. al. JOHNSTON, PFAHLER, PANCOAST). In Europe, the first experiments in this the-

rapy were made in France (BERGONIÉ 1905, followed by BARJON, REDARD and others). WETTERER's and KIENBÖCK's are the first works to be met with in German literature. FORSSELL appears to be the one who introduced this therapy into Scandinavia (probably from BERGONIÉ's institute 1907), and in England it is mentioned in the same year by CULLOCH and later on by GARDENER, PIRIE and others.

First after HEINEKE's and his followers' investigations as to the influence of the X-rays on the body's lymphoid tissues, investigations which opened up a new aera, did there arise a general interest in this usage of the Roentgen ray. The first larger and systematically revised clinical material of Roentgen-treated lymphoma cases was presented by ISELIN in 1910, and it was his work which more than anything else gave the impulse to the complete changing of the lymphoma therapy which took place during the following years. Hitherto this had been considered as a surgical scope and as the principal method was generally accounted the radical lymphoma extirpation, performed preferably at an early stage on purely intracapsular processes, but, as was considered, equally indicated even in caseous lymphomata with periadenitis. The so-called conservative operations on the contrary, i. e. incisions with scraping out, punctures, eventually in connection with injection of antiseptics, such as iodoform emulsion, zinc chloride, camphor-naphtol etc., according to CALOT's example, were saved for solitary glands with fusion or fistulous formations.

As a reminder of the important rôle lymphoma surgery played in our hospitals at this time, it is worth mentioning that in 1908 no less than 7 % of the entire number of operations performed at the surgical clinic in Lund were lymphoma operations, a figure only surpassed by appendicitis and hernia operations, and by the operations on bone and joint tuberculosis.

During the next ten years the X-rays had so completely taken the place of the operating knife that the above mentioned figure had in 1918 sunk to 1 %.

This thorough-going development took place almost simultaneously at most surgical clinics, and in the many works which have since appeared concerning the results of the new method of treatment, radiotherapy has unanimously been awarded the place as the principal, though not the sole dominating method of treating tuberculous lymphomata. This disease is generally considered as incomparably the most profitable scope for Roentgen treatment within the boundaries of surgical tuberculosis.

First it may be suitable to say a few words about the *diagnosis of tuberculous lymphadenitis.* Differential diagnosis at an early stage

between tuberculous lymphomata on one side and lymphosarcoma, resp. lymphogranuloma on the other is by no means always easy to make, and in many cases is first made positive after exploratory excision, sometimes not even then. Without entering too closely into the various details of the clinical differential diagnostics between these different categories, I only wish to point out, by the way, that the influence of the Roentgen ray upon lymphatic gland tumours is not seldom applicable even for differential diagnostical purposes, as HOLZKNECHT and KIENBÖCK and later on KNOX have already held forth. A number of lymphosarcomata and also lymphogranuloma disappear much more quickly than the tuberculous lymphomata. On the other hand it is quite right, when the glands show unusual resistance, to suspect the possibility of lues and have the WASSERMANN test made. What, however, I first of all wish to draw attention to here is the large occurrence of lymphomata which very greatly resemble the tuberculous, but are, all the same of completely different origin. Such can arise e. g. after scarlatina, after chronic or often recurring anginae, and also on the basis of long-lasting, neglected dental caries. These glands can show almost every form that is to be found in tuberculosis, so that the differential diagnosis is often exceedingly difficult. Exploratory excision is preferably avoided on cosmetic grounds, the PIRQUET test is diagnostically inapplicable and even the intra-cutaneous tuberculin injection is, in such cases, of value only with a negative result. It is quite certain that in many lymphoma statistics a great number of such cases are to be found under the name of tuberculous lymphomata. In the literature I have had the opportunity of studying BAENSCH is the only one who has taken any notice of this point of view.

A closer description of *the pathological anatomy of tuberculous lymphadenitis* does not fall within the range of this work. In this respect I beg to refer to the accounts in the handbooks: e. g. that of MOST in Neue Deutsche Chirurgie (1917). On the other hand I consider it advisable to linger a little over one point, viz. the importance of a correct conception of the nature of the process in the particular case. Following KIENBÖCK's and WETTERER's classification, three different forms or rather stages of development are, from a clinical point of view, of old distinguished, viz.:

I. simple, hyperplastic lymphomata, without fusion;
II. closed lymphomata with central caseous formation or fusion;
III. open, fused lymphomata with fistulae, ulcerations or scrofuloderm.

ISELIN includes only 2 principal groups, closed and fistulous lymphomata, and adds scrofuloderm to them as a third. BARJON on the

contrary in the cases of the third group makes a difference between cold and hot abscesses and under the last-named rubric he inserts several subgroups.

As I have already remarked, it is often impossible for us to clinically diagnose either central caseous formation or commencing fusion, therefore I consider it more adequate to make no difference between these stages, but instead to take up the presence or absence of periadenitis (which can always be stated) as a mark of distinction between the two first groups.

The above classification does not, however, by any means satisfy the demands for conformity between the clinically occurring forms of lymphoma and the pathological-anatomical changes in the tuberculous tissue. In this respect the following scheme first proposed by W. MÜLLER and used by PEYSER and JÜNGLING, is decidedly to be preferred.

I. *Tuberculous lymphogranulomata.* (Clinically soft, hyperplastic glands, histologically parenchymatous tuberculous granulation hypertrophy.)

II. *Fibrous lymphogranulomata.* (Clinically moveable, swollen glands, slightly harder than the above-mentioned, histologically tuberculous granulation tissue with proliferation of the interstitial connective tissue.)

III. *Tuberculous fibrolymphomata.* (Clinically hard, not tender, enlarged glands, histologically fibrous sclerosis.)

IV. *Tuberculous lymphomata with caseous-purulent necrosis.* (Clinically tuberculous abscess with or without a completed perforation, histologically tuberculous granulation tissue with caseous resp. purulent fusion.)

V. *Tuberculous fibrolymphogranulomata with caseous necrosis.* (Clinically hard, aggregated, fixed glandular tumours, histologically central, caseous necrosis, resp. purulent fusion, with peripheric fibrous formation of connective tissue and periadenitis.

To this PEYSER adds the *calcareous lymphomata* as a special variety. — Form I can go to direct resorption, or develop in a regressive direction to forms II and III, or by progression to form IV. Form V can finally arise from II or III and constitutes the least favourable result. It is, however, not always possible clinically to separate these forms of lymphomata — especially II and III — and it is then necessary to fall back upon the above mentioned scheme according to MOST, of which I make use in this work as well as in my former one, as the primary statements in my material do not allow a reliable classification conformable to MÜLLER.

The clinical process of the tuberculous lymphadenitis varies in Roent-

gen treatment according to the pathological changes which prevail in the particular case. Therefore it is necessary, in this respect, to consider the special groups one by one.

I. *Simple hyperplastic lymphomata* (MÜLLER's tuberculous lymphogranulomata, including forms II and III or the transitions to IV). The Roentgen influence is here introduced in a great number of cases by an *initial reaction*, which usually sets in already a few hours after irradiation or on the next day and is manifested by an oedematous swelling of the region treated, together with a feeling of tension and pain. Not uncommonly, especially in young girls with a sensitive vascular system, a reddening of the irradiated skin is observed at the same time, often with a rise of the temperature to 38°, seldom higher. We have probably here a form of the usual roentgenological so-called »pro-reaction» as described by HOLZKNECHT, KIENBÖCK, BERGONIÉ, SPÉDER and others, combined with an increased local irritation caused by a sudden breaking down of lymphoid tissue and leucocytes. A number of patients complain further of dryness in the mouth, probably caused by a transitory oedema in the salivary glands. ISELIN declares even that swallowing trouble can occur, caused by the swelling of the glands near the angle of jaw. This initial reaction often causes a certain anxiety in the patients but will generally disappear in the course of the next few days. BAISCH states that he has often noticed it in children with marked scrofulous appearance, and also in such cases as give a decided positive PIRQUETS reaction, a view which I have not found supported by other authors and on which I, with regard to my own principally policlinical material, am not able to form a decided opinion.

The true therapeutic effect of the irradiation takes place first later and fairly slowly and is visible, at the earliest, 2 or 3 weeks afterwards. The more the granular tissue coincides histologically with MÜLLERS group I, the greater the chances are for healing to take place without any complications, entirely regardless of the size of the glands. It is not uncommon to see a considerable diminution already after the first irradiation, and after 3 or 4 the complete disappearance of the glands. The atrophy takes place more slowly if a greater or smaller proportion of fibrous connective tissue is present; such lymphomata do not as a rule completely disappear, but leave remains in the form of hard, moveable, fibrous nodules, of the size of grains up to that of beans or hazel nuts, according to the size and nature of the original glands. By the consistency of these it is often possible to gain an opinion in advance as to the proportion of connective tissue present, in other cases it is first to be perceived from the development. In such cases I generally —

like PETERSEN among others — gradually increase the length of the pauses between the treatments from 4—5 weeks to 2—4 months, more frequent irradiations do not particularly hurry on the reduction of the glands, and in this way unnecessary risk of lesions of the skin is avoided.

On excision of such remains of glands BAISCH has found that they consist of fibrous connective tissue, sometimes mixed with caseous matter but without either epitheloid or lymphoid elements. Thus, as a rule, it may be right to regard such nodules as cicatrices and such patients as healed. To separate such cases and those quite free from symptoms as RUNSTRÖM does, appears to me rather unnecessary, an opinion which is confirmed by many authors (PEYSER, JÜNGLING, PETERSEN and others), REYN also looks upon such cases as healed provided the glandular remains are small, quite moveable and not tender. According to my experience it is also very seldom found that a relapse is caused by such nodules with decided fibrous consistency. No glandular remains larger than a small hazel nut are included among the healed cases in my statistics below.

The Roentgen treatment of glands, which from the beginning belong to the group of fibrous lymphomata, gives no result, and is therefore unnecessary. Such glands are especially to be found on the lower part of the throat, also in fossa submaxillaris, and are characterized by their hard consistency, their often nodular form, their moveableness and nature of not being tender and seldom attain greater size than a hazel nut. They can undergo many months' treatment without the slightest effect.

On the other hand, it ought to be mentioned that apparently pure, hyperplastic lymphomata without periadenitis can all the same not seldom harbour central, caseous or fused foci which after Roentgen treatment may in short time develop an abscess without it having been possible to state this tendency beforehand. I shall return to this later.

According to my experience an average time of treatment of 6—7 months must be counted on for the regression and healing of the cases (including those containing connective tissue) belonging to the group now mentioned. This figure is based upon 59 cases, which were so continuously treated, that such an estimation could be made.

II. *Lymphomata with diffuse periadenitis*, caused by the spreading of the tuberculous changes to the subcapsular parts of the glands, which become the seat of inflammatory irritation, that by degrees spreads to the surrounding parts and causes an aggregation of the glands into large tumours in which the individual glands are often

not palpable. This group corresponds thus nearest to MÜLLER's group V. The large glandular tumours are generally situated near the angle of the jaw where the lymph vessels from the most important ways of infection, viz. the mucous membrane of the mouth and nose, have their entrance. These tumours sometimes attain such a size that they take up the whole lateral part of the throat, and are not seldom bilateral. In less advanced cases the lower parts of the throat are occupied by more moveable lymphomata which increase in size upwards. As has already been implied, these massive glandular tumours very often contain central caseous necroses or abscesses, which are then surrounded by fibrous glandular capsules, made still thicker by periadenitis. In many cases abscesses with threatening perforation are to be found from the beginning. On the other hand glandular bunches with periadenitis of more recent date also appear, containing principally hyperplastic tuberculous granulation tissue. To what extent the changes now described are present in the particular case cannot always be clinically discovered. A certain help can be obtained by the anamnesis, i. e. the age of the lymphomata, but first and foremost the real knowledge of the present pathological-anatomical changes is to be gained from the progress during continued Roentgen treatment.

On the whole the cases belonging to this class can be considered as giving the smallest returns to Roentgen therapy. Certainly I have amongst my material several cases of large glandular tumours which have been cured, leaving insignificant remains in about the same time as the preceding group; tuberculous hyperplasia in a predominant degree has plainly been present here. The typical cases mostly regress much more slowly, a fact which other authors, e. g. WETTERER, RAPP, ALTSCHUL, PEYSER have also been able to state. I consider, from my own experience in this field, that a complete cure of the cases in question takes on an average from about 9—10 months; at the same time it must be remembered that the pauses in the treatment in many of the cases are long and irregular.

The less favourable prognosis in this group is certainly dependent on the abundant fibrous adenitis and periadenitis, which only allow a slow reduction and which prevent the resorption of the central caseous necrosis, a process which is also, according to ISELIN, very slow and often incomplete. Therefore many cases do not become completely healed, only a lessening of the glandular bunches with increased sclerosis taking place in a larger or smaller degree. These remains may form the grounds for recurrences or late fusions and ought therefore to be extirpated, if possible. In consideration of this the X-ray treatment ought not to be carried on so long that

operation becomes unnecessarily difficult on account of general fibrosis.

Again, if fusion can be ascertained during the Roentgen treatment, or perforation and fistulous formation appear, the case has then passed over to the next group.

III. *Fusing, fistulous or ulcerating lymphomata* (corresponding to group IV according to MÜLLER, incl. the cases from the preceding groups which have passed over into this condition whilst under Roentgen treatment). To this group belong, in my material, as well as in that of most others, the greatest number of patients.

Every roentgenologist knows from daily experience that after Roentgen treatment of tuberculous glands purulent fusion can arise of which not the slightest trace could be seen before. This change ought, with the greatest probability, to be ascribed to the mass breaking down of cells which takes place on irradiation. According to MENNE, autolytical ferments which have a dissolving effect upon the albuminous colloids of the cells are supposed to be set free in this way. Especially the breaking down of lympho- and leucocytes, as demonstrated by BAISCH, ought to be of great importance here. ISELIN considers that on irradiation the organism gains an increased power of reabsorbing these breaking down products. It may be more probable, that, as PEYSER believes, the ferments above mentioned have the effect of furthering resorption, by making the cell detritus in question more »digestible». If, however, the resorption can not keep time with the increased breaking down the result will be the formation of abscess.

As already has been pointed out, this change in soft, quickly growing lymphomata of group I can occur already after a single irradiation. On the other hand it can take a long time before manifest fusion in the large fibrous glandular tumours will occur. It is not unusual for a mixed infection, such as angina, a measles, to be the cause of such a suppuration. This process can be confined to a single gland — usually the largest one — or it can spread over a larger area. For draining of an abscess of this kind puncture is recommended by many, e. g. BARJON, BAENSCH, MOLL, MÜHLMANN, WETTERER, as being cosmetically the most satisfactory. Not seldom, however, the fusion will in spite of this, progress and threaten the skin. I have, on this account, of late years confined the puncturing to solitary, early and completely fused glands, and always make the puncture uppermost and in healthy skin. After some repeated punctures and renewed irradiations the yield becomes more serous and it can happen that the secretion stops and healing sets in.

In most cases, however, the suppuration continues and an incision becomes necessary. Therefore I prefer, nowadays, to make this incision directly, trying however to wait until the fusion is complete, so that the abscess can be totally drained. As PETERSEN rightly points out, the patients by this method have the advantage of most easily getting rid of the caseous matter. Together with the incision I almost always perform as complete a scraping out of necroses and capsular remains from the abscess sinus as possible, in doing which it is important to allow the ladle to penetrate into all parts of the sinuses. On this account it is advisable to narcotize; for children and young people I can, without hesitation, recommend the use of ethyl chlorid, having used it for several years without any disagreeable consequences whatever. For adult men is ether narcosis more suitable. The incision is, of course, made in the most declivous place and as small as possible. After scraping, a tampon of iodoform lint is placed in the sinus, and this must be removed after a couple of days. I never use injections with iodoform glycerin etc, nor do I continue the tamponing. By these means secondary infection is generally avoided and also the formation of superficial granulation masses. Often only one scraping is required after which the wound closes and, under continued X-ray treatment, heals primarily, leaving a scar so small that after a time it is almost impossible to find it. Primary suturing of the wound appears to me, contrary to BAISCH, PETERSEN, PEYSER and others, unnecessary and meaningless, partly for cosmetic reasons and partly with regard to the possibility of renewed scraping.

In cases where fistulae or scrofuloderm are already formed at the beginning of the Roentgen treatment, an initiatory, thorough scraping out ought to be made, after which the ulcers will as a rule fairly quickly become purified and heal under the influence of the X-rays. In these cases also, the scars as a rule differ favourably from those usually seen after purely surgical treatment, where primary suturing could not be made. They are soft, smooth and generally of a pale colour, and the tendency to form keloids and disfiguring epithelium bridges is generally lacking. On the other hand it is only just to emphasize that in a number of cases the scars are not so satisfactory, from a cosmetic point of view: this specially occurs when an incision has been made on a previous occasion, and tampons have been kept in the wound for some time, or when obstinate, repeated fusions take place, necessitating many renewed scrapings.

In cases with a tendency to iterated suppurations the process is often favourably influenced by the application of aluminum acetate compresses during the pauses between the irradiations, so that a renewed scraping may be inhibited. In ordinary cases a plain, dry

bandage during a week after the incision is all that is needed. For the same purpose, I have, during the last two years, specially in children with abundant, slack granulations and secondarily infected fistulae, with great success combined X-rays with general quartz light irradiation, for a period of a few weeks, provided the patients lived so near that they could come to the hospital every day. In this way the secretion usually will cease more quickly, the sinuses purify, and the fistulae close. Any special increase of radio-sensibility in the skin as a result of this treatment has not been observed, and in order to prevent a possible irritation I generally allow a week to elapse after the Roentgen treatment, before I begin with the quartz light. A similar combination with light treatment has been systematically carried out by REYN (see below) and is recommended by several others, as TIXIER, KÖNIG, and to a certain degree also by the Tübingen clinic. The artificial light bath in some form or other is to be considered a good substitute for sunlight which, as we know, plays an important part in the treatment of most forms of surgical tuberculosis.

The suppurating or fistulous lymphomata are often mentioned in literature as the least suitable for Roentgen treatment (e. g. by BERGONIÉ), probably on account of the fact that the period of healing for this group, owing to the repeated abscesses, is considerably longer than in the preceding one. Thus BAISCH states the average time to be about 1 year, WETTERER 10—15 months, DISSON and RAPP 14 months. In my former work I put down the average time of treatment in cases belonging to this group to 8—10 months, estimated from a group of 76 patients, which it had been possible to treat continuously. It is not quite unusual, however, for free intervals, from $^1/_2$—1 years, even up to two years to occur in this group after which the treatment must be taken up again owing to renewed formation of abscesses. Taking all such cases into consideration, an average time of from 14—15 months will be arrived at, although the greater number are of course cured in a shorter time.

As, however, even in these cases, where surgery as a rule fails, Roentgen therapy is able to attain a relatively good cure of a percentually higher number of patients than in other groups, and further the patients, by scraping out the abscesses, quickly and thoroughly become free from the caseous and tubercular masses of tissue, the results of the Roentgen treatment within this category must be acknowledged as extremely favourable.

I will now proceed to impart the tabularly concentrated results of X-ray therapy in lymphomata as experienced in Lund, such as they appear after two after-inquiries, carried out partly during the

summer of 1920 and partly during the present winter. The first named inquiry comprised the material from the ten years period 1909—1918, the latter cases from 1919—1921. Here is also included every case from the first mentioned period which owing to relapse or continued treatment has again appeared. I have no impression that, among this material, any particular number of cases have stayed away on account of a poor result, as REYN considers usual amongst his patients. On the contrary, patients here are generally anxious to return if they become worse.

In the first statistics there were 380 cases, of which 94 were excluded as inapplicable; of the remainder, 286 cases, 206 (70 %) had responded either personally (the greater number) or by letter, according to a special form. The present year's investigation comprises a total sum of 384 cases, of which 90 were inapplicable; of the remaining 294, only 131 could be after-examined, most of them on their appearance in person, only a few by letter. This unexpected, unfavourable result is probably owing, partly to the latter year's precarious economical conditions and the many removals subsequent, partly and not least to the hoof and mouth disease which has ravaged since the New Year and prevented many from coming.

If we throw both the final sums together, we come up to a total number of 337 Roentgen treated lymphoma cases. Naturally all diagnosed cases of malignant tumours, lymphogranulomatosis, lues etc., are beforehand excluded from this sum. Besides that, I have considered it necessary to try to eliminate as many as possible of the cases, mentioned on page 6, sent in for treatment under a tuberculous diagnosis without actually being tuberculous. On this account there have been excluded 67 cases, which, owing to their course together with direct reports concerning illnesses of the kind above mentioned, could reasonably be regarded as of non-tuberculous nature. The real number of such cases is possibly still larger. In this way the total sum sinks to a number of 270.

As *cured* or *free from symptoms* I denote, in table I. below, such cases in which either no glands at all could be met with on the after-examination, or only smaller fibrous remains of less than a hazel nut in size were left, which had not increased after the close of the treatment and were otherwise of such a nature that they could be considered as fibrous scars. Among the *improved* are counted, partly such cases in which the diminution of glands has not attained such a degrée that healing can be spoken of, partly such as have gone to operation after the glands have been considerably reduced, partly again cases in which the treatment has not yet come to an end. As *relapses* I have noted cases of newly formed

Table I

Whole number		Cured	%	Improved	%	Relapses	%	Deaths	%
Group I	73	53	74	13	17.8	3	4.1	4	5.5
Group II	45	24	53.3	13	28.9	5	6.7	3	6.7
Group III	152	120	79	14	19.2	15	9.9	3	1.9
Total	**270**	**197**	**73**	**40**	**14.8**	**23**	**8.5**	**10**	**3.7**

lymphomata which after the close of the treatment have appeared either within or in the immediate neighbourhood of the old area of irradiation, of course, though, no cases of new glands in the non-treated parts of the throat. Amongst these are also to be found 6 cases which in the statistics of 1920 were counted as healed or improved, but which afterwards relapsed. Finally concerning the *deaths*, their number is, as far as I know, only 10, of which 6 died of pulmonary tuberculosis, one of tuberculous meningitis, one of influenza and 2 of other intercurrent illness.

Table II

Whole number		Cured	%	Improved	%	Relapses	%	Deaths	%
Group I	70	49	70	14	20	3	4.3	4	5.7
Group II	32	18	56.2	9	28	2	6.2	3	9.4
Group III	104	88	84.6	6	5.8	9	8.6	1	1
Total	**206**	**155**	**75.3**	**29**	**14**	**14**	**6.7**	**8**	**4**

Table II contains statistics from 1920. A comparison shows that the percentage of cured has risen slightly in group I but fallen in both the others, especially group III, so that the total percentage has decreased from 75.3 to 73. This is, probably, principally owing to the above mentioned censuring of the lymphomata cases which were considered as of a non-tuberculous nature and which, to the greatest part, healed extremely quickly and well under Roentgen treatment, after drainage of the abscesses. The group »improved» does not present anything worthy of notice. There, I have also placed 4 cases of extremely fibrous glands, which only showed a very moderate atrophy. The percentage of relapses is again slightly increased from 6.7 to 8.5 on account of the above mentioned 6 cases from the older material being put in. All the relapses have been treated over again and cured with the exception of 2 who are still under treatment.

The period of observation for the older material has varied from 8 to 2 years; I have afterwards seen a considerable number of these patients again during the years 1921—1924, and have had the opportunity to after-examine them. As far as the recent material is concerned, I reckon with a period of observation from 4—2½ years.

It may further be of interest to compare these statistics with those from the Seraphimer Hospital, imparted by RUNSTRÖM, which embrace 145 cases, divided into 4 groups according to results, viz.: — completely free from symptoms 53 cases (36.7 %), cases with smaller, palpable glandular remains 77 (53.1 %), relapses 14 cases (9.5 %) and not healed 1 case. It is possible, though not certain, that the 2 first mentioned groups together fully correspond to my group I; RUNSTRÖM himself considers that his first group of »symptomfree» cases is probably too large, and perhaps there may be contained here a number of cases which ought more likely to be included under the rubric »improved». At all events the percentage of healed ought here to exceed 80, which must be regarded as an exceedingly fine result, in consideration of the material, which is principally derived from the poorer classes. What position RUNSTRÖM has taken regarding the group of »non-tuberculous» which I have excluded is, however, not to be found from his work. The percentage of relapses, 9.5, corresponds very nearly with my own which ISELIN also points out as his average figure.

Among the foreign statistics I will first and foremost mention ISELIN's which out of 551 patients shows 390 healed (70 %). Of these 273 got re-examined several years after, and among them were only 25, thus 9 % suffering from genuine relapse. WETTERER (1920) has 376 cases with 87.5 % healed and 10 % relapses, MOLL (1915—1918) 263 cases with 82.7 % healed, 11 % improved and 3.4 % relapses. PEYSER's statistics include 75 cases of which 90.7 % were healed, 4 % unimproved. Finally, as an example of what can be done by Roentgen treatment in connection with hospital care and carefully observed general hygiene, sea baths, etc., I will quote RAPP's (perhaps too optimistical) healing total of 100 % in all three groups.

In proceeding to a comparison with the results obtained by *surgical* treatment only, we will first quote the collective statistics made by BLOS which includes only 48.6 % genuinely cured and 51.4 % relapses (here are included a number of cases with new glands). Later on (1899), BLOS imparts statistics from the clinic of Heidelberg alone of 140 cases with 73 % cured after more than 6 years, on 85 of which extirpation had been made, on the others smaller

operations. Renewed operations had to take place on half the number of cases. FÜRNROHR reckons (1896) 41 % permanently healed, DOWD again has 250 cases with 54 % healed after 10 years, NEVES has gathered 800 operated cases with 75 % healed.

JÜNGLING holds forth, however, that such figures could only be obtained if the statistics comprise a specially large number of closed lymphoma cases without fistulae. The result of surgical treatment of suppurating lymphomata is decidedly worse. Thus FINKELSTEIN calculates 116 primarily healed (60.8 %) out of 172 cases belonging to the first group, whilst of 107 suppurating lymphomata only 24 % got cured, and of 90 cases with fistulae only 25 %. VOELCKER rightly remarks that such comparisons are somewhat uncertain owing to different methods of operation, and also different material, and points out, in connection with this, how statistics from GARRÉ show 13.3 % relapses in private patients, but even 36.8 % in patients in the general wards, a natural result of the many neglected cases among the latter.

Even if such differences are taken into consideration, we can still gather from the figures above quoted that in cases of tuberculous lymphomata X-ray therapy, as here described and in combination with smaller necessary surgical operations, must without doubt be considered as to its clinical results far superior to the earlier prevailing, purely surgical, and this specially within the category of cases, in which surgery is of least avail, viz. the suppurating and fistulous lymphomata.

On the other hand it is necessary to radiotherapy's disadvantage, to hold forth the long period of treatment, which can stretch over several months or even years in the suppurative cases, although with longer intervals during which the patients as a rule are able undisturbed to perform their work. Farthermore there will remain, with X-ray therapy, a certain degree of uncertainty as to the final result, an operation having, for a number of cases, still at last to be advised. Concerning the direct risks connected with Roentgen irradiation I beg to refer to the following.

The technique of treatment in tuberculous lymphadenitis has followed as a rule the development of the therapeutical X-ray technique on the whole, except certain modifications in dosage, made necessary by the peculiarities and method of reaction of the tuberculous tissue.

When, by means of HOLZKNECHT's chromoradiometer, it became possible practically to apply with a certain degree of safety »the

expeditive method» of KIENBÖCK, this speedily won ground and began to be used in the larger institutes of Europe (KIENBÖCK, BÉCLÈRE, BERGONIÉ, SABOURAUD-NOIRÉ). Concerning the tuberculous lymphomata KIENBÖCK gave, in 1907, from the beginning as a single dose 1/2—1 »normal dose» (10 X). BERGONIÉ on the contrary treated his first cases with doses of 2—3 H only, given at intervals of 1—2 weeks, during the latter part of the treatment extended to a month.

The *filtration technique* also traces its origin to the same time. To begin with, filters of tinfoil, glass, india-rubber and leather were used, but later on these were superseded by the 1 mm. aluminum filter recommended by PERTHES.

These principles of treatment were introduced into Sweden by FORSSELL (1906—1907) who then, in order to be able to measure smaller amounts of radiation than 5 H, made use of BORDIER's scale with SABOURAUD's pastilles, placed on half of the focal distance. Under such conditions the erythema dose lies between tint II and III of the scale. Thanks to these principles of FORSSELL, we never, at this time, used larger skin doses in lymphoma than 2 H, later on increased to 3 or 4 H, with pauses of first a week and then 12—14 days. In Germany WETTERER recommended already in 1908 doses of 4 H for non-suppurating and 5 H for suppurating lymphomata with a filtration of glass or leather. Somewhat similar technique was used by many others in the treatment of lymphomata (BAISCH, FRITSCH, ISELIN in his earlier years).

The principles of deep therapy having, in 1913, gained a firm footing owing to the systematic investigations of GUILLEMINOT, BARKLA and the Freiburger school it was made possible to irradiate even larger lymphomata with stronger doses without overcharging the skin. Already before 1912 ISELIN had thus begun to filter with at least 2 mm. aluminum. His technique was followed by BAISCH and PETERSEN who, however, increased the filter thickness to 3 mm. In Denmark REYN has, since 1913, treated lymphomata with a filtration of 4—6 mm. In Sweden, on the other hand, it was some time before these principles were carried out; this seems to have taken place earliest at Lund (1914—1915), whilst at the Seraphimer Hospital the 1 mm. Al-filter was used up to 1918 (RUNSTRÖM).

The dosage varied at different clinics. ISELIN would not, with regard to eventual skin lesions, exceed 2 1/2 H for children under 6 years of age, 3 1/2 H for older ones, and 5 H for adults, with intervals of 2—4 weeks. On the other hand WETTERER already in 1914 recommended a dosage of 6 H for children and 10 H for adults. Still stronger doses appear to have been used in Germany at this time. Thus MOLL (Freiburg) gave an average dose of 25 X with a

3 mm. Al-filter and intervals of 3—5 weeks, MÜHLMANN (Stettin) on the other hand 10 H every 4th week with 3—4 mm. Al-filter. At Lund, however, we found no reasons to increase our dosage very much. As a rule I have given with 3 mm. Al. 1½—3 H, with 4 mm. Al. 4—5 H (in resistant or deeper situated glands). Children did, as a rule, not receive more than 2—3 H. Three or four weeks has been the shortest interval during treatment.

After the introduction of homogeneous irradiation and the heavy metal filters (KRÖNIG and FRIEDRICH, SEITZ and WINTZ and others) as also the development by the Erlanger school of the biological method of dosage, there was a great ardour in many quarters to apply these reforms also to the lymphoma therapy. Thus, DISSON in 1920 gives an enthusiastic relation of his results with this technique (½ mm. zinc filter, tubes with 35—40 cm. spark gap and a dosage which reminds very much of deep malignant tumour therapy: for adults 100 X, for older children 50 and for younger 25—30 X). He relates further how large glandular tumours which had not succumbed to irradiation with 3 mm. Al-filter have, with this technique, melted away after a few seances. Similar experiences are reported by RAPP (Rappenau) who, however, generally uses Al-filter to save time and has a somewhat more cautious dosage, not exceeding 40—50 X for adults. Provided no great mistakes are present here in the results of measurement, severe skin atrophy must, in many cases, most unquestionably have been the result of such treatment, although, as far as I know, they have not been published. This can be indirectly understood by int. al. such communications as STARK's. He systematically treated his lymphoma cases with doses of 1 H. E. D., with zinc filter, repeated 3 times, and considered he had found that such cases which did not get cured after these irradiations would not, on the whole, be improved by continued treatment. In a later publication he declares all the same, that he, owing to skin lesions having taken place, found himself obliged to limit his irradiation to 2 and only in cases of necessity and after an interval of 3 months give one more. Dearly bought experience, indeed!

As a contrast HOLFELDER's technique may be described. A convinced adherent to homogeneous irradiation, he uses as a rule in treatment of surgical tuberculosis irradiation from many fields with »Felderwähler» and doses of 40—60 % H. E. D.; in lymphomata, on the other hand, as an exception unilateral irradiation with a small focal distance, avoiding homogeneous irradiation on account of the sensitive soft parts and organs of the throat. He does not, however, mention the size of these doses.

WETTERER has, in the last edition of his manual, increased the lymphoma doses to 8—10—15 H, repeated up to 15 times, doses which surely, even with the supposition of zinc filtration, surpass the limits for the allowed.

This tendency has, in some degree, reached even Scandinavia. Thus REYN says he has, of later years used lymphoma doses of 10—15 H with 5—6 mm. Al-filter, with which, all the same, rationally enough, the intervals were also prolonged till at least 5—10 weeks. It is clearly seen from his work that many skin atrophies must have been the result. The same trouble occurred at the Seraphimer Hospital in Stockholm, where during 1920 doses of 1 H. E. D., against custom, came to use. At Lund I have as a rule kept to doses not exceeding $^1/_4$—$^1/_3$ H. E. D. with a filter of 3 or 4 mm. Al. At the first irradiation only I have, in a great number of cases, given as much as $^1/_2$ H. E. D. When in a series of cases from 1916 and 1917 the doses were on trial and exceptionally increased, to 8—10 H with 4 mm. Al. (corresponding to about $^2/_3$ H. E. D.), skin atrophy later on appeared in most of these patients, which made me very soon abandon this method.

It is plainly to be seen from the literature of later years that similar experiences have been gained in other places. Thus, PEYSER and ALTSCHUL recommend a decrease of the lymphoma doses to under $^1/_2$ H. E. D., BAENSCH declares that doses of 1 H. E. D. may cause increased temperature and other general symptoms and therefore the figure mentioned ought not to be exceeded; but in case of serious changes the doses are to be still further decreased. In his last, excellent work, JÜNGLING advises a dosage of 10—50 % H. E. D.: »if the skin dose is chosen so, that about 10 % will reach even the deeper parts (of the glandular tumours, whose depth is estimated to at most 3 cm.) this ought to be sufficiently exact». Further, JÜNGLING does not consider it necessary to keep to the zinc filtration as the rays filtered through 3 mm. Al. appear to guarantee sufficient homogeneity. Only with very large glandular tumours and old fistulous cases does he use zinc filter. Bilateral glandular tumours are irradiated with 20 % from each side or both sides alternately with a fortnight's interval. This return to more cautious doses is expressly stated to be a fruit of several years' experience of more aggressive technique.

Although, according to this, a certain agreement concerning the general features of the technique appears now to be attained among the authorities, much still remains to be done before such a state of things is arrived at, that in lymphoma treatment exactly the same dosage can be reproduced at different clinics. According to

what MARTIUS showed at the Naturalist Meeting at Innsbruck, 1924, the intensity of the dose conception 1 H. E. D. varies at different German clinics between 66 % and 258 % of the H. E. D. dose used at Bonn, if this be put = 100 %. Until a uniform definition of this dose-conception, based on objective, physical grounds, has been accepted, it is quite plain that very varying amounts of Roentgen light will be applied under this name, and that all the dosage reports have, at present, a very relative value. Not least is this the case with the so-called »tuberculosis dose» of 50 % H. E. D. as given by SEITZ and WINTZ, a conception which must be looked upon as absurd, considering the great varieties in localization and depth and also in the clinical character of the tuberculous processes. Only this can at present be decided upon, that in tuberculous lymphomata the special doses ought to be considerably under half of that dose which at every clinic is designated as 1 H. E. D.

Concerning *the most suitable ray quality* I am inclined to join with HOLFELDER's opinion, that lymphomata can be treated with any Roentgen apparatus. In agreement with JÜNGLING I do not consider it necessary either to use heavy metal filters, the homogeneity of irradiation being quite satisfactory by filtration with 3 or 4 mm. Al. The use recommended by RUNSTRÖM of zinc or copper filters for large glandular tumours and fistulous cases, in which beforehand a long period of treatment might be calculated, the theoretical correctness of this demand can not be disputed, but my experience from the last 10 years treatment of lymphomata appears to me to show that, on suitable dosage, there is hardly any real need for such filtration. It is the same with the thicker Al-filters of 5—6 mm. which are used for instance by REYN. They only increase the length of the irradiations without corresponding, practical benefit. On the other hand, it would not be advisable to go under a filter thickness of 3 mm. Al., because the skin, owing to too great absorption, would then run the risk of being injured on repeated irradiations.

The *cross-fire irradiation* formely used and recommended by KIENBÖCK, is, with the present ray quality and filter technique no longer of any practical importance except with unusually large and prominent lymphomata. By increasing the focal distance to 30 cm. and using a 4 mm. Al-filter, I think a quite sufficient homogeneity in irradiation is gained, to enable the lateral part of the neck being treated in one field, especially as it forms a concave surface, the outer points of which will lie at about the same distance from the focus of the Roentgen tube as its centre.

Concerning the question as to the most suitable *length of treatment intervals*, it is plain that these are, firstly, wholly dependent

upon the size of doses given. Further, one must consider beforehand, that a longer series of irradiations may become necessary, and therefore the skin must on no account be overcharged from the beginning with too frequent doses of rays. Supposing an average dose of 1/4 to 1/3 H. E. D., intervals of at least 4, willingly 6 weeks ought to be counted upon, according to my experience. BAISCH states that already the own time of reaction of the lymphatic glands requires about a fortnight, exclusive of the preciding latent period. With stronger dosage, an interval of 6 weeks is to be regarded as the minimum. Also in prolonged treatment it is necessary to increase the pauses for the sake of the skin. In pronounced fibrous lymphomata I have, like PETERSEN, made it a rule to put in long intervals of from 2 to 6 months, during which time the regression may continue spontaneously. The condition of the skin also decides the *number* of Roentgen treatments it may be considered right to give. If, however, a cautious dosage has been given, with properly weighed intervals and suitable filter, the radio-sensibility of the skin will seldom be an obstacle to the extension of the number of irradiations to about a dozen, if it should be found necessary. Here, the clinical nature of the special case plays a certain rôle as the ulcerated and fistulous processes will generally cause a decided increase of the sensibility of the skin. Hence HOLZKNECHT's often repeated rule: the more severe the tuberculosis, the smaller the doses. It is quite clear that on the slightest suspicion of skin atrophy, the treatment ought to be stopped, so as not to risk a cosmetically satisfactory result.

Measures were recommended, at an earlier period, from sundry quarters, partly in order to *increase the own radiosensibility of the lymphomata*, and partly in order to produce a *desensibilization of the skin* in the irradiated area. For the first mentioned purpose was used int. al. venous stasis according to BIER, injection of tuberculin into the glands (ISELIN), further diathermy (ISELIN, SCHMIDT). As, however, these methods are not likely to be entirely without risk and further the sensibility of the glandular tumours generally will allow, with the help of an ordinary technique, a satisfactory ray effect, they may now be considered as unnecessary, not to say unsuitable. The same may be said of the later attempts to *obtain an increased secondary ray effect* by injection of metal salts in the area of treatment. On this method, PEYSER justly remarks that it is impossible to distribute such a medium evenly and diffusely enough, so as to gain the aim, and further that an inappropriate absorption of the primary irradiation might be the result. Equally unnecessary is the desensibilizing of the skin, used by G. SCHWARZ in lymphoma

treatment, by anemia, produced by pressure, cold or injection of adrenalin. Practically, such measures may very seldom have come into question in this field.

The development of the technique of treatment in lymphadenitis, described above, shows that an insight has now been gained as to the limits within which it has to move, if the production of therapeutical results of full value, but at the same time the avoidance of all risks for the patients is desired. Now there remains only some consideration of these *risks* which may be connected with the X-ray irradiations.

First, I must as shortly as possible remind, that formerly, the possibility of the *spreading in the organism* of the tuberculous process, nay, even the appearance of *miliary tuberculosis* in connection with Roentgen treatment was feared, and that such cases are also recorded. They are, however, so extremely uncommon, that it is impossible seriously to put them into connection with the irradiation. It is also extremely uncommon for Roentgen treatment to cause general toxic symtoms or other serious by-effects of a general nature; for my own part, I have not observed one single case of this kind.

On the other hand, concerning *local*, injurious effects within the area of treatment, I think these may with certainty be avoided, provided a cautious and suitable technique were used. Lesions such as chronic, indurated Roentgen edema, atrophy of the salivary glands, necroses of the larynx etc., are consequences of a now abandoned intensive therapy, and should not be allowed to occur.

Another risk which has been held forth specially by PETERSEN concerning irradiation of lymphatic glands, is, that the organism by the degeneration and total atrophy of the whole system of lymphatic glands within the irradiated area, might loose the important safeguard against infection which the same is intended to form. This fear may, however, on the whole be groundless, because according te HEINEKE's investigations the lymphoid system is capable of an unusually strong power of regeneration, and besides, as far as I know, no such disadventageous results of the X-rays have, up to the present date, been known. Much nearer lies the possibility of the *skin injuries*, to which I have referred several times in the preceding pages and which are now known by every radiologist.

These injuries, first described by ISELIN in 1912, are to their nature to be considered as *lesions of the vascular system* in the skin, with accompanying different degrees of *atrophy*. Such atrophy can appear after a single irradiation, which has exceeded the erythema dose, and is then caused by an obvious technical mistake. In other cases similar changes arise by the summation of a series of successive

irradiations, and then generally will appear a longer or shorter time after the close of the treatment, sometimes even a year and a half afterwards. They may be caused by insufficient filtration, i. e. too strong absorption of soft rays into the skin; further by too large, recurring doses, whose effect, without any of them having attained the erythema limit, has, however, cumulated by degrees; by too long continued irradiations with smaller doses; and finally by too frequent treatments, eventually with the cross-fire technique, leaving the skin no opportunity of recovery. The slightest degree of such changes is represented by a constant pigmentation, principally in brunette individuals, then follows a slight degree of atrophy with dryness and brittleness of the skin without further changes. Much more serious, because really disfiguring, are the higher degrees, distinguished by teleangiectasis of varying appearance and density, as well as by pronounced atrophy with depigmentation and wrinkles. In the most serious cases secondary Roentgen ulcers, eventually followed by cancer, may appear.

In my former work on X-ray treatment of lymphomate (1920) I had to ascertain a series of 36 cases of skin injuries, 17 of which were very slight, the others more or less pronounced, with teleangiectasis etc., altogether 17.5 % of the cases treated, curiously enough the same figure recorded by RUNSTRÖM. Of these, 26 i. e. 12.6 % belonged to group III, the suppurating glands, which both require the longest treatment and also are well known as being most susceptible to Roentgen lesions. These cases were mostly treated in 1914—1916, when the deep therapy technique was under development but the dosage, owing to lack of experience, was still varying and uncertain. Besides, there was a series of cases from 1916—1917 in which I, influenced by statements in German literature, experimentally tried a stronger dosage (at most 10 H, with 4 mm. Al. given several times with intervals of from 4 to 5 weeks), but which I later on abandoned, no improvement of the results appearing. No severer injuries than atrophy with teleangiectasis occured among these patients.

Among the considerable number of cases belonging to this material, which I saw again during the following years, I have only found one single further case of atrophy. In the material from 1919 to 1921, which I have, as above mentioned, for the greater part personally examined, I have not met with more than 3 cases of skin lesions. The first of these patients had been treated before, in 1917, 8 times with 5 H and 3 mm. Al-filter, on both sides of the throat. The three following are treated in 1920. One of these received, within 2 months, 2×10 H and 2×5 H, partly with $^1/_2$

mm. Cu-filter and partly with 4 mm. Al. The next one has received 10 series of treatments, mostly from several fields each time and with doses, varying between 7 and 1 H, all with 4 mm. Al. The last one was also treated 10 times, and received twice 8 H, 3 times 7 H, once 6 H and 4 times 5 H. In all these cases, my usual dosage has been more or less exceeded.

Thus, the total percentage of established skin lesions amounts in my whole material at the present time to 15 %, whilst in the material from 1919—1921, having taken care to avoid these changes, only 2.3 % are met with. Therefore, without exaggeration such cases can be considered as pure exceptions, provided a cautiously and reliably performed technique is followed. That here a prudent individualization of the method according to the nature of the different cases and their manner of reaction against the irradiation is of extreme importance, is rightly emphasized by STEPP and RUNSTRÖM and has also been pointed out by me. Other recent works on this subject, e. g. PEYSER's and JÜNGLING's, also express the decided view, that such local damages under similar conditions could as a rule be avoided.

There is really only *one* author, in later years, who appears to hold a divergent opinion, viz. REYN, whose statements oblige me to discuss his work more in detail.

REYN states that of 553 cases of tuberculous lymphomata treated at the Finsen Institute 86.6 % were healed, whilst 3 % show relapse. The material is divided into 4 groups, according to the nature of treatment:

1) light bath+local Finsen light . . . . 81 cases of which healed 98.7 %
2) light bath+local Finsen light+X rays 105 » of which healed 92.9 %
3) X rays+local Finsen light . . . . . 112 » of which healed 83.9 %
4) X rays alone . . . . . 247 » of which healed 39.3 %

The severest cases, with large glandular tumours in 50 % of the number, are said to be found in groups I and II, group III includes principally fistulous cases of a more favourable nature, and the last group is mostly composed of hyperplastic glands without suppuration.

The low percentage of healing in this last group is surprising, as it forms a striking contrast to the reports of all the preceding authors, according to whom the closed, hyperplastic lymphomata are

generally considered the most favourable. I myself have 74 % healed in this group.

However, REYN also reports results of X-ray treatment of fistulous glands, which he himself considers as extremely poor, as out of 26 only Roentgen treated cases no more than 2 (= 7,7 %) have healed. On account of all this REYN comes to the conclusion that radiotherapy is far from being an ideal method of treating lymphomata, and that a great number of patients are not cured at all by it. Concerning the group »improved» he remarks that this word means here the same as that the patients still have their illness, and are liable at any time to a new outbreak of the same. The favourable results reported in literature he simply refers to the contrast to the results of the surgical treatment, which are still worse.

Further, in addition to all this, REYN points out very emphatically the great risk which lies in the above described X-ray injuries, being plainly influenced in a high degree by his own experience in this respect. To be sure, he does not directly mention, in how many cases he has observed such lesions, but says he has seen them after irradiation as well with doses indicated above as too large and decidedly dangerous, as even after frequently repeated treatment with doses of 5 H with 3 mm. Al. As an explanatory reason for these injuries he alleges the possibility of individual over-sensibility, especially in plethoric people with high complexion, and in skin with inflammatory changes, and he criticizes other authors who have omitted mentioning these risks.

I can fully agree with REYN that the need of a carefully guided technique with small doses, sufficient intervals and suitable filters etc. can never be too much emphasized, but when he will assert, that there is never any safety at all against such skin lesions, even though the greatest precautions are taken, that our knowledge of the effect of X-rays on the skin is exceedingly small, and that the Roentgen therapy is based on very unsafe foundations, both now and for many years to come, then he goes most decidedly too far.

Concerning the poor results of X-ray treatment at the Finsen Institute, he tries to explain them partly through his X-ray treated cases having been exceedingly severe, with an average anamnesis of 6 months in adults and 2 years in children. If the seriousness of the cases is to be considered in accordance with this scale, then I can give the information that, in my material from 1919 to 1921, the group I has an average anamnesis of $1\,^3/_4$ years, group II of $3\,^3/_4$ years and group III of $1\,^1/_2$ years, and that my cases cannot thus, at least, be considered more favourable. REYN further maintains that he uses a stricter definition of the term »cured» than

others. As to this, I can only remark that I have myself at least used this definition in the same meaning as he does.

As an explanation of the less favourable results in REYN's group IV, I should like to suppose that, quite apart from the inappropriate dosage recognized by himself, a great number of these »hyperplastical» lymphomata were in reality more or less fibrous, and therefore *were unable* to give any more striking results, either with X-rays or any other method of treatment (except extirpation). The large glandular tumours, again, which REYN considers extremely serious, need not by any means be considered as a priori unfavourable as they, in a great number of cases, even those operated on before, may very well get completely cured by Roentgen treatment. Further, concerning the fistulous glands, REYN himself assigns as the reason of his low percentage of cure, that X-ray treatment in these cases was not so energetically carried out, as he very soon turned to the combination with Finsen light. As it is, however, precisely these cases which need the longest time of Roentgen irradiation, it is hardly surprising that REYN's treatment showed such erroneous results.

On such a basis REYN further grounds a comparison with his results of general and local light treatment, combined with X-ray treatment or not, and holds forth the extraordinary importance of these forms of therapy, as fit to influence the whole organism and distinguished by an extremely high average of cure. I willingly acknowledge the correctness of this and express my satisfaction that a therapy exists, which in a clever and experienced hand can attain such results, but, on the other hand, it is plainly to be seen that light treatment will never be able to take the place of X-ray therapy, partly because it is much more expensive in practice and partly because the light technique requires that the patients must be irradiated every or every other day for a long time, and therefore must practically live in the same place. REYN himself states that the duration of light treatment in the different groups averaged 4,8 resp. 7,7 and 9,7 months. It is perfectly absurd to propose such a method of treatment for lymphoma patients, when healing can be effected in most cases in about the same time by Roentgen therapy by one irradiation every 4th or 6th week.

Regardless of this, I want to emphasize, on this occasion, the decided benefit to be gained, according to my experience, from a combination of X-ray and light therapy, either in the form of arc light baths or universal quartz light irradiation. For my own part, I have only had the opportunity of using the latter, but I have seen good results from it in the last two years, in a series of cases

of obstinately suppurating glands and abundantly granulating, slack fistulae, eventually complicated with scrofuloderm and reduced general condition. I have then given quartz light for a few weeks between the Roentgen treatments, and have been able to ascertain, as a rule, that the secretion and granulation have ceased and the fistulae closed much more quickly than otherwise. I have not been able to observe any risk in this combination, on account of increased sensibility of the skin at following X-ray treatments, as has been stated from several quarters.

There is not, however, and ought not to be the question of an attempt to gain success for any special therapeutic method in the treatment of tuberculous lymphadenitis, but of an attempt to restore, in the best manner, as many invalids as possible to health. Surely all methods have in this respect their field of application and their limits. It is exactly the same in radiotherapy which, as I have previously emphasized, must frequently be assisted by small surgical operations and which also, in a number of cases, under suitable outer conditions, may be favourably combined with, or replaced by, light treatment. A further question is now how the indications on account of the experience hitherto won ought be put with regard to the mutual relation of the X-ray treatment and the so-called radical extirpation.

A number of radiologists, e. g. Kienböck, Baisch, Petersen, do not appear to count on the necessity for greater surgical operations. Stepp also considers that X-ray treatment will fail only in very exceptional cases and reminds of the difficulty of operating in a tissue that has been treated with X-rays a long time. Bergonié, Mühlmann, Peyser, Jüngling declare that strongly indurated and caseous granular tumours must not seldom be extirpated, and the last two further urge a radiological post-treatment after this operation. Koennecke, on the contrary, will reserve the operation for solitary, mobile glands only. The superiority of the radiotherapy in the treatment of lymphomata is nowadays usually held forth by the surgeons (Krecke, de Quervain, Wilms, Voelcker, Fr. König and others), the latter int. al. emphasizing the illusiveness of a so-called radical extirpation. Lexer and Iselin, on the other hand, prefer to extirpate primarily, as soon as the lymphomata are large, solitary and fairly free, and then to add a postoperative irradiation. Bier, finally holds an isolated position in this question, recommending to treat surgical tuberculosis with general hygienic therapy together with fresh air, sun, hemostasis and iodide of sodium internally.

The following indications appear to me, in this respect, to result from the experiences, I have had the opportunity of gaining.

Lymphomata, belonging to group I, ought to be irradiated even if they feel solitary on palpation, for it is impossible to exclude smaller, infected glands in the neighbourhood, which could, extirpation made, later on cause a recurrence. Such an operation can always be performed secondarily, if disappearance of the lymphomata should not be observed after 4—5 irradiations. Smaller fibrolymphomata, as being harmless and completely insensible to X-rays, ought not to be treated at all, larger ones, which are disturbing from a cosmetical point of view, ought preferably to be extirpated. — Group II contains the greatest difficulties, from radiological as well as surgical point of view. Here, as a matter of principle, Roentgen treatment ought to be begun with, as it leads in a great number of cases to health, and in most of them at least to a considerable reduction of the glandular tumours. If these, however, should prove resistant, the irradiation ought not to be continued until such a fibrosis of the tissues has appeared, that a surgical operation is made considerably more difficult, but instead the patient ought to be remitted in good time for operation. — Group III, again, ought to be reserved for X-ray therapy, which is here absolutely superior to the knife. It is appropriate to post-irradiate the operated cases, in order to decrease the chances of recurrences as much as possible.

B. Tuberculous Peritonitis

There exists, as is known, three different clinical forms of this disease: — the exudative which manifests itself by a copious dissemination of tuberculous, gelatinous or caseous nodules together with ascites; the adhesive, with either thin, fibrous or tumour-like voluminous adhesions between the abdominal organs, with abundant tubercles, caseous necroses and small fibrinous exudations; and finally the purulent, ulcerous form, characterized by bowels and omentum being confusedly aggregated with masses of adhesions and purulent exudations. Of these forms the last one at least may be difficult to diagnose without autopsy.

Concerning the *operative treatment* of tuberculous peritonitis, surgeons appear nowadays, owing to the works presented by Borchgrevink and Rose, to agree, that its results are less favourable than was formerly esteemed, especially with regard to the final results. Thus, operation appears to cure only about 40—50 % of the exudative cases and perhaps 25 % of the adhesive cases, while the purulent, ulcerous cases are extremely unfavourable (Frank's statistics from the clinic of Czerny). Pagenstecher and Thöne, again, reckon 53,9 % of 247 operated cases as completely cured, of cases with exclusive

conservative treatment only 40,8 %. SHATTUCK's figures from the Mass. Gen. Hosp. are resp. 65,5 % and 32 % for the same groups. Therefore, it was not surprising that the communications of the elder BIRCHER as to favourable results of X-ray treatment in tuberculous peritonitis aroused the greatest interest. Already in the years 1899—1906, he had collected a material of 28 cases treated with X-rays and divided into the following 2 groups.

A. Operated cases, where Roentgen rays were used as post-operative treatment: — 16 cases, of which 43 % cured, 31 % improved and 25 % dead.

B. Only Roentgen treated cases: 12, among which are found a number of inoperable, adhesive-plastic and caseous purulent forms, as well as recurrences, which got cured. Favourable results were attained in this group in 50 %.

BIRCHER was even then able to draw up the following indications for X-ray therapy in this disease.

1) The following cases ought to be primarily X-rayed, viz. such plastic-adhesive cases, which are not suitable for operation; and further cachectic cases which are inoperable owing to a bad general condition, or which refuse operation.

2) Combined laparotomy and X-rays ought to be used as well in such cases, where the exudate does not quickly disappear after operation, as in recurrences after operation.

BIRCHER has later extended these indications in so far that he gives post-operative treatment in all the operated cases. If the exudate is very large, it ought always to be removed before Röntgen treatment is begun.

In 1920 BIRCHER published new statistics of 155 cases, out of which 53 were treated with X-rays after laparotomy, 102 only irradiated. Within the former group 64,1 % became cured, 30 % improved and 5,7 % died; within the latter 55,8 % were cured, 40,2 % improved and 3,9 % died. On account of these results Roentgen treatment began to be used almost everywhere and many publications upon it have been issued.

Thus, ISELIN has treated 66 cases, of which 44 have been after-examined. 59 % of these are cured and 18,3 % have died.

Since 1915 STEPP has treated about 50 cases with excellent results, and he considers that next to leukemia and tuberculous lymphomata, the tuberculous peritonitis of all internal diseases shows the best results of Roentgen treatment, provided no more serious degree of lung tuberculosis is present. The material is not statistically revised, but of the cases irradiated up to 1920, more than 30, all of a serious kind, have, without exception, got cured.

We have further collective statistics by BRASSER, from the clinics of Tübingen, according to which 54,8 % of the cases treated there got cured, 22,6 % were improved, the remainder unimproved.

LANG's opinion is also favourable. The adhesive form, which he considers very little suitable for surgical treatment, shows great improvement after 2 or 3 Roentgen irradiations, the disease enters into a mild stadium and the patients become able to work again. The exudative cases again ought above all to be first operated upon and then irradiated, in which case the result will often be better than without Roentgen, as ascites does not so easily return.

Out of BECK's 35 cases, 29 (= 82,9 %) became cured, 2 improved and 4 unimproved.

BAENSCH has observed satisfactory results especially in children.

HOLFELDER estimates 60 % of the whole number of his cases to be cured: all the light cases, all the adhesive forms as well as the cachectic patients having been irradiated directly, the greater number of exudative cases, on the contrary, first secondarily after operation.

MOLL agrees pretty nearly with BIRCHER's indications, WETTERER also. Statistical reports are not given.

WEIBEL finally reports, from the 2nd gynecological clinic in Vienna, not less than 41 cases of tuberculosis of the peritoneum and the female genitary organs which have been treated solely by X-rays and which have shown very good results in 82 %; the mortality was 18 %, and the material has been under observation, in most of the cases, for more than 3 years. In 12 cases both these localizations were present, and all showed excellent results. Existing ascites has been punctured in advance, but in adhesive forms no surgical operation has been performed. This treatment has made it possible to avoid intestinal fistulae.

Concerning the results with *different clinical forms* of tuberculous peritonitis, both ISELIN and STEPP appear to consider them as about equally good in adhesive as well as in exudative cases. BIRCHER again had, out of 72 exudative cases, 62,5 % cured, 34,7 % improved and 2,3 % deaths, while of 88 plastic-adhesive forms 52,3 % got cured, 36,3 % improved and 5,9 % died. LÜDIN, as well as most others, also considers that it is the exudative forms which give the best result from X-ray treatment, the ascites being able to disappear even without previous surgical operation. He finds that even the tuberous forms are favourably affected, although not so rapidly.

I myself can only account for a series of 13 cases of tuberculous peritonitis, treated from 1918—1921. They are divided in the above mentioned groups so, that 8 belong to the exudative, 4 to the adhesive and 1 to the purulent ulcerous cases.

Four of the exudative cases have been irradiated in connection with laparotomy; of these 3 are well, 1 shows a primarily satisfactory improvement, but has not been after-examined. One patient has undergone laparotomy twice for the same disease and, five years later, was X-rayed for a new recurrence and since then (5 years ago) has been quite well. In one case tuberculous peritonitis was ascertained at an operation for appendicitis; the patient got X-rays afterwards, but broke off the treatment and has not been heard of since. The remaining 2 have been irradiated without previous operation; one of them is well, the other primarily free from symptoms but not after-examined.

Of the four plastic-adhesive cases, two have been operated on and afterwards irradiated, one of them with a remaining fistula, which healed; the other two are primarily treated, the after-examination this year shows all well.

The last case was a man, 27 years old, with bi-lateral lung tuberculosis, ileo-coecal tuberculosis and ascites with a coecal fistula after operation. The treatment resulted in a greatly improved general condition, increase of weight and decrease of the abdominal tumour; the condition on after-examination unaltered.

With regard to the *clinical course* of the tuberculous peritonitis with Roentgen treatment, a fairly rapid and obvious improvement takes place here in most cases, expressing itself in an improved general condition and appetite, decrease of fever etc. If ascites is present, a rather quick decrease of the same can, as a rule, be stated, so that tension and swelling of the abdomen decrease, and respiration becomes easier. It seems to be uncommon for an exudate to increase again after the beginning of X-ray treatment, but now and then it happens, however, that the resorption will get on slowly, so that the last remains disappear first some weeks or months afterwards.

Light cases with ascites, where operation is not indicated, ought, according to BIRCHER, to be primarily irradiated and will then react rapidly and steadily.

The adhesive and still more the purulent-ulcerous cases are, as a rule, rather more resistent and therefore require a longer time than do the ascitic. Even here, however, the resistance mostly diminishes fairly quickly and the abdomen becomes softer, even if it takes a comparatively long time — often 6 months and more, according to JÜNGLING several years sometimes — before complete cure will be obtained.

For these cases, BIRCHER proposes laparotomy and cauterizing of the abdominal cavity with spirits of iodine, followed by Roentgen treat-

ment, a combination which has not been tried in any of my cases and which JÜNGLING — and rightly too, as far as I can see — dissuades from on account of the danger of iodine poisoning and increased formation of adhesions.

BIRCHER values the results from X-ray treatment so highly, that he considers the irradiation to be indispensable. He says he has never observed spontaneous resorption of an ascites which has existed more than 3—5 weeks; in cases operated upon, the exudate will remain in at least 40 %, if they don't get X-rays afterwards, in which case many of them get cured. A further, favourable effect of the Roentgen rays is that the irradiated cases show no tendency to formation of fistulae.

Whether the drainage of the exudate ought to be made by laparotomy or by puncturing appears, according to some opinions, to be a matter of choice, as the relieving of the serosa takes place in both cases. The internists, such as STEPP, and also WEIBEL and BAENSCH, as a rule seem to prefer puncturing. It must, however, be said that the abdominal cavity is more thoroughly drained by laparotomy, eventually combined with suction of the fluid. The hyperemia as well as the mechanical irritation of the serosa, which are considered as the cause of the healing process, perhaps will be more efficient on operation. It appears, therefore, as if there was much, at least theoretically, in favour of an operation of this nature, although the results do not seem to be worse on the other side.

The X-ray technique has of late years been the object of most interest in this disease. It has been changed here, more than is usual in tuberculous diseases, in accordance with the general technical development. Great difficulties are met with here, in consideration of the large extent of the area of treatment and the varying site and depth of the affection from the cutaneous surface. The front layer of the parietal peritoneum thus lies very closely under the surface of the skin, whilst the back one may lie 10 cm deep and more. The disseminations of tuberculosis which affect the peritoneal covering of the abdominal viscera, must, naturally, change still more in depth. Consequently, on irradiation from the front, the doses for different parts of the peritoneum must show great variations.

BIRCHER used, in his earlier years, unfiltered rays and had the abdomen divided into a number of smaller areas. He has later on adopted the use of only 4 areas and gives 10 X on each one, with 3 mm Al-filter (occasionally larger doses), and an interval of 3 weeks. With this technique the greater number of his cases have got cured after 3 X-ray series during $2^1/_2$—3 months; others, again, have re-

quired 4—6 months or more. Similar technique is still used by a number of radiologists.

When the biological method of dosage used by SEITZ and WINTZ became known and the same autors drew up their definition "tuberculosis dose" of 50 % H. E. D., there were many attempts made to follow this technic by irradiation partly from the abdominal and partly from the dorsal side. Thus, STEPP in Giessen gives 4 fields from each side with 3/4 H. E. D. on each together with 1/2 mm Zn-filter and 30 cm distance, acknowledging all the same that no really homogeneous irradiation takes place in this way.

The Erlangen radiologists went still further in the "struggle for homogeneity" by introducing great focal distances, 50 cm and more, and larger areas, taking the whole abdomen in one séance, and eventually irradiation both from the abdominal and the dorsal side (in corpulent people) with 50 % H. E. D. on each. This technique has been accepted by HOLFELDER (1921).

JÜNGLING strongly opposes these efforts, not without right remarking that in such extensive areas of treatment not only must the "focal dose" be taken into consideration, but also the "total dose"; by means of calculations he demonstrates how this technique in accepting WINTZ' tuberculosis dose of 50 % H. E. D., comes up to an absorbed total quantity of Roentgen rays which is 2 1/2 times larger than that calculated in a so-called "Roentgen-Wertheim". As a symptom of the over-irradiation obtained he points out the very severe "Roentgenkater" which affects patients treated in this manner and which absolutely must be avoided. Besides, for women is added the danger of castration connected with such doses and further possibly injuries to the adrenals.

Happily, however, such dosage is not carried out in practice, so that the risks for patients are not, in reality, as great as may be feared from the theory. In order, however, to avoid all traces of both "Roentgenkater" and other involuntary injuries JÜNGLING has decreased his "focal" dosage as low as STEPHAN's dose of 10 %, which must be further fractionized if the general condition is low. In no cases may the total dose for the whole abdominal cavity amount to a WINTZ' castration dose. Therefore, he recommends calculating the dose per kg body weight, not exceeding 270 J. per kg (intensity units) divided between a large abdominal and a dorsal area and using intervals of from 5 to 8 weeks between the different series.

In my own cases I have made use of a modification of BIRCHER's technique, as I have divided the field of treatment into a varying number of areas (2—8) partly on the abdominal, partly on the

dorsal side, and treated them with doses usually varying between 3—5 H, sometimes (in children) as small as 2 H, filters of 3—4 Al., and intervals of, as a rule, 4, sometimes 6 weeks. A rapid improvement has been observed, almost without exception, after these treatments, never any "Roentgenkater" or other troubles.

Only in one case was the treatment not completed as the patient (an hysterical case) discontinued it on account of abdominal pains. It is, however, undeniable that the technique of JÜNGLING is fully rational and logical. It only remains to be seen if the results of it are better than of the last described one.

It may be said, as a total judgment of the X-ray therapy in tuberculous peritonitis, that it greatly improves the prognosis in the exudative cases, and that it, also in the adhesive, resp. purulent-ulcerous ones, where the result of an operation is unsafe or unfavourable, is able to cure a great number of cases. Regarding the category of peritoneal tuberculoses which, according to ROSE and BORCHGREVINK, heal spontaneously and therefore ought not to be operated upon, it might be rational to still more improve their chances by means of X-ray treatment.

C. Urogenital Tuberculosis

I have no personal experience at disposal in this field and must therefore confine myself entirely to reporting the most important facts in literature within the different groups.

1. *Kidney tuberculosis*

On looking through the works treating this application of Roentgen therapy the meagreness of the reports presented is very striking.

STEPP appears to be one who disposes over the greatest experience; he starts from the observation that kidney tuberculosis is very often not unilateral but, after performed nephrectomy for tuberculosis of the one kidney, will after a short time develop also in the other. Cystoscopically both orifices of the ureters have been found infected in a large number of cases, indicating bilateral kidney tuberculosis, and thus inoperable. With regard to the excellent results in peritoneal tuberculosis "the idea of attempting X-ray treatment also in kidney tuberculosis presents itself". Thus, STEPP considers, as indications for X-ray treatment:

1) Cases in which after unilateral nephrectomy the other kidney becomes tuberculous.

2) Cases with bilateral tuberculosis, or cases in which it is not quite certain that the second kidney is intact.

3) Case of unilateral kidney tuberculosis where the patient refuses an operation "or where one wants to exspectate".

STEPP reports a series of 11 cases treated during later years. Among the histories quoted are 3 cases, all suffering from kidney tuberculosis after the exstirpation of one kidney and treated with X-rays. One of these patients got better, but died of tubercular meningitis a year later, another was better for a short time, but had a severe hemorrhage afterwards (prostate? kidney?); the history is not finished. The third appears also to have become somewhat better, but the urine still contained red corpuscles and the condition was very labile. The results of these cases are not very brilliant, and no real conclusions as to an eventual curative effect of Roentgen therapy in kidney tuberculosis can be drawn from them.

Plainly influenced by STEPP's too optimistic view of things, LANG has given a generally formulated opinion that, latterly, "surprisingly good results have been obtained" in kidney (and bladder) tuberculosis, with discontinuation of the process after 1—2 irradiations. He certainly discretely adds, that such cases as show a tendency to spontaneous healing ought to be irradiated and undergo general strengthening treatment. The facts present not being stronger, we must, unhesitatingly, acknowledge that JÜNGLING is right, when he emphatically rejects all thoughts of X-ray treatment except, possibly, in cases which for one reason or other cannot be operated, i. e. positively bilateral cases, tuberculosis of the other kidney after nephrectomy, or in cases where operation is absolutely refused. Concerning the cases "which tend to spontaneous healing" it is hardly possible to clinically distinguish them in an early stage, therefore this indication can not, on any account, be maintained.

Opinions of the same kind are met with from other authors who have discussed this subject, e. g. BECK, VOGT, who reminds that the operative treatment of kidney tuberculosis leads to permanent health in 60—70 %, and has a mortality of only 1—2 %. But he considers that post-operative treatment of tuberculously infected wounds and fistulae after nephrectomy is of great value, with which JÜNGLING also agrees. I have occasionally had such cases under treatment and have no unfavourable impression of them, but the material is not large enough to justify a decided opinion.

As to the *technique* in X-ray treatment of kidney tuberculosis, JÜNGLING points out that the whole ureter region and also the bladder must be included therein, also that the depth doses ought only slightly to exceed 20—30 % H. E. D., if unpleasant general effects are to be avoided, a fact which I find I can fully agree with. VOGT goes up to 50 % at the highest.

Finally may be mentioned that post-treatment by Roentgen rays of the remaining tuberculous ureter fragments, resp. fistulae, after nephrectomy, is recommended by HOLFELDER as well as JÜNGLING and other authors, as an excellent means to attain a quicker healing of these affections.

2. *Bladder tuberculosis*

Not counting miliary tuberculosis, we have always, in bladder tuberculosis in both sexes, to do with a continuation of the disease from a primary kidney tuberculosis. Infection from the genitalia does not practically appear to occur.

The issue of a bladder tuberculosis is thus entirely dependent on the course of the fundamental kidney process. If the kidney is removed, the changes of the bladder will, in many cases, spontaneously heal out. If, again, the kidney tuberculosis is bilateral or if tuberculosis develops in a kidney remaining after unilateral nephrectomy, the bladder tuberculosis, according to general surgical experience, can probably not be cured. A curative effect on bladder tuberculosis by means of X-rays may therefore be confined to the cases where nephrectomy has been made, but the bladder affection has not ceased. This, of course, does not prevent that *improvement* may be achieved now and then, even in other cases, by this treatment.

Experiences in this field are not particularly great. WETTERER is extremely optimistic about his results in some 15 cases, of which 8 were combined with kidney tuberculosis, 4 with contemporaneous genital resp. urethral tuberculosis. Eight of these became much better, 6 "apparently cured". Among these latter were three cases of kidney tuberculosis and it follows even from this that no permanent cure is likely to have taken place here. WETTERER, however, has been able to observe, according to his own report, how edema and redness of the mucous membrane have decreased and the ulcers healed with smooth scars; a certain degree of injection, however, remained. Pain and hematuria also decreased resp. disappeared, and the general condition was improved. However, nothing is said by WETTERER with regard to the subsequent course of these cases.

STEPP has further, in the 11 cases of kidney tuberculosis mentioned above, also treated the bladder, which he first filled with collargol, with the intention of increasing the ray effect by its secondary irradiation. Without this technical expedient he says he should not have attained any result, and no injury of it has been observed. Great improvement both subjectively and objectively, has

occurred in 3—4 of the cases mentioned, without the bladder, however, having shown in any of the cases a fully normal cystoscopic picture. None of the patients has been under observation more than a few months after the conclusion of the treatment.

With regard to dosage, WETTERER gave 10—15 H, according to the penetration of the rays, on each of 4 areas over the region of the bladder, the remaining technical details not being mentioned. STEPP only says that he, in order to save time, was obliged to irradiate the bladder with 3 mm Al-filter and gave "as large doses as possible" up to strong brown pigmentation.

JÜNGLING recommends X-ray treatment as a means of relaxing the painful urethral spasms and, in this manner, gaining subjective relief for the patient; otherwise in support of the healing process after unilateral nephrectomy. BECK mentions the same indication. JÜNGLING proposes a dosage of about 30 % H. E. D. with great caution.

3. *Tuberculous epididymitis*

This disease *can* appear as a primary localization of tuberculosis. Whether, in an advanced urogenital tuberculosis, the testicle is to be considered as the source from which the affection has spread in an ascending direction, or on the contrary a descending way of spreading, for inst. from the prostate, is to be regarded as a rule, is, on the other hand, at present undecided. Under all circumstances the epididymis is in tuberculosis almost always earlier affected than the orchis and the disease remains unilateral for a long time.

Most surgeons hold the opinion that early performed castration or at least epididymectomy in all cases of unilateral tuberculosis is the only correct method. On the other hand, many authorities are found, especially in France and even in Germany, who proceed from the fact that epididymitis in light cases may heal spontaneously with fistulae and calcification, on which account a conservative treatment, eventually with epididymectomy or even smaller surgical operations ought to be tried, and castration to be reserved for cases where the whole testis is affected. In bilateral epididymitis again, and in tuberculosis of the other testis after unilateral extirpation, it may be more difficult to decide upon such a mutilating operation as a total castration.

On the other side, as far as the results of X-ray treatment in tuberculous epididymitis are concerned, the situation appears to be rather obscure. WETTERER reports 10 irradiated cases, of which 3 had fistulae or periorchitis, the rest having the orchis also affected. Three of the latter were operated on and afterwards irradiated. The

primary result in all the cases was good, but in 2 cases the disease proceeded to the prostate and bladder. A steady improvement was noticeable in the 7 other cases and 5 are said to be cured quoad nunc. Unfortunately we do not know how long this period of observation was. Exactly the same may be said of the cases of closed epididymitis, without suppuration, treated by RAPP, and reported as cured.

HOLFELDER, in unilateral epididymitis, recommends extirpation with retaining of the orchis which ought afterwards to be X-rayed. According to BAENSCH, the X-ray results in PAYR's clinic with a large material of tuberculous epididymitis are excellent, most cases being cured under cessation of the caseous secretion, closing of the fistulae, and gradually arising calcification. The dosage is the same as for glands; the unaffected parts are covered as much as is possible. BECK, again, reports the indications at ANSCHÜTZ' clinic in Kiel, where the unilateral cases are always operated on, but in bilateral tuberculosis and in recurrences after unilateral extirpation, X-ray treatment of the other testis is preferred; the doses do not exceed 30 % H. E. D. In 5 cases of remaining fistulae, complete cure took place in a short time.

FREUND has treated 15 cases, of which 3 are cured, the others improved, so that the process was confined to the affected side. ULLMAN has had extremely favourable results in 24 cases.

JÜNGLING is very sceptical as to the reports of permanent cure of epididymitis by X-ray treatment, especially in caseous and suppurating forms, and says he has not observed more than improvement. But the risk of infection for the other testis is not done away with by this. On the other hand, he eagerly advises irradiation of eventual fistulae proceeding from the remaining part of the vas deferens. Concerning dosage, he advises not to allow the single doses to exceed 20 % H. E. D. and emphasizes the necessity of sparing as far as possible those parts of the testis which have not been destroyed by the disease. In Lund, we have no results in this field to record. It ought to be clear from the above report that the indication for X-ray treatment must be very restricted, in about the same manner as in kidney tuberculosis, even though the prospects of good results within these limits may be considered as decidedly brighter.

4. *Tuberculosis of the female genitary organs*

is no common disease. According to SCHRÖDER, the number of cases belonging to this category comprise only about 1 % of the clinical and policlinical gynecological material. In by far the greatest number of cases it occurs as a secondary localization and is in 85—90 %

of all cases a tubar tuberculosis, in $^2/_3$ of all cases the uterus is affected, and in $^1/_3$ the ovaries.

The hematogeneous way of infection is generally considered as by far the most usual, in $^1/_3$ of the cases tuberculosis of the genitals is complicated with general peritoneal tuberculosis, probably most often as a parallel localization from the same primary focus. That the Fallopian tube is the commonest primary place of infection may be explained by local changes owing to gonorrhea etc.; from here, the disease usually will spread in a descending way along the lumen of the genitary canal itself, or fairly often through the lymph vessels. Otherwise, the process very often spreads upwards to a localized pelveoperitonitis.

The diagnosis of these affections usually appearing under the picture of an adnex tumour is clinically often difficult and requires histological examination to be made with certainty. From surgical quarters it is, therefore, recommended, especially in acutely commencing cases, to try the use of conservative treatment at first and await before proceeding to operation. The latter is considered to be indicated, if such measures do not lead to the desired result, further, if mixed infection, bleeding, or severe pain is present, or if the affection can safely be considered as uni-lateral.

Many gynecologists, however, declare that the surgical extirpations, owing to the progressive tendency of the process and weakening influence on the organism, are rather dangerous, and that an operation mortality of 10—15 % must be counted upon (Vogt, Schröder). Entirely contraindicated is the operation if other tuberculous affections, especially in the lungs, are present. Even incision and drainage of large pyosalpinx sacs ought to be out of the question, on account of the danger of secondary infection and fistulae.

In marked chronic, harmless tuberculous processes an operation can possibly be indicated on social grounds, and it is then performed as moderately as possible, (partial extirpations etc.). Such cases are often, although after a long period of illness, regressive; the same can also occur without operation, provided a long stay at a sanatorium is possible.

It is not surprising that, under such circumstances, considering the favourable results of X-ray therapy in other tuberculous complaints, the same treatment has, of later years, been tried in the diseases in question. As far as I know, Vogt (Tübingen) was the first to publish a larger material of this description (1920), viz. 46 cases, of which 14 were solely radiologically treated and nearly all were bilateral.

Amenorrhea was caused by the treatment in all the cases, 6 of

them were restored to full power of work, 3 were improved to 50 %, one remained unimproved and 2 died of their tuberculosis.

VOGT holds forth, as advantages connected with Roentgen treatment, that it does not cause any primary mortality, that the stay at the hospital including examination, abrasion and X-ray treatment, can be limited to 5 or 6 days which means a decided decrease in expense. Further, on the appearance of amenorrhea the symptoms of sterilization are less acute after Roentgen treatment than after operation, and there is a certain possibility for the patients to regain their menses.

VOGT bases the following indications for X-ray treatment on his own experience:

1) Cases with tuberculous endometritis without symptoms from the appendages or peritoneum, but with dysmenorrhea or bleeding.

2) Cases in which operation is for some reason contraindicated (ascites, fever, tuberculosis of the lungs or other organs).

In unilateral tuberculosis of the adnexa an operation is as a rule to be preferred, in bilateral, radiotherapy can easily compete therewith, in consideration of the possibility of renewed fertility. As tuberculosis, as a rule, by itself will cause sterility, such a result of the X-ray therapy forms no contraindication.

In a later work, VOGT points out that the practically most important form of X-ray therapy is the post-operative irradiation, which is carried out by him as well after simple laparotomy with drainage of ascites as after radical and conservative operations, on the appendages, except in the cases in which sterility is the principal indication for the operation. Further, he declares here that X-ray treatment does not imply the risk of abscesses of the abdominal wall or of fistulae, so common after operation, whereby the number of permanently cured cases is increased from 66 % with surgical treatment to 87 % in combination with post-irradiation.

At MAYER'S clinic also attempts are actually being made to reduce operations as much as possible in favour of Roentgen treatment.

Similar experiences are related by WEIBEL and LANG among others.

WEIBEL (II Wiener-Frauenklinik in Vienna) has thus 41 cases of tuberculosis of the peritoneum or the genitals which have been treated with X-rays with a favourable result in 82 %, and a mortality of 18 % (most of the cases were under observation for more than 3 years).

In 12 of the cases both localizations were present; all gave excellent results, as the tumors of the appendages and the intestinal conglomeration regressed and the pain disappeared. WEIBEL considers X-ray therapy less dangerous than operation, and almost certain in

its effect. The appearance of amenorrhea can not be considered as a disadvantage, as menstruation is more to be looked upon as a periodical irritation which aggravates the tuberculous process. Operation is, therefore, by him only performed as an exception.

Concerning the *mode of action* of the X-ray treatment, it is mostly considered to be both local and general, as the general condition improves and the body weight increases simultaneously with the regress of the local changes. This latter is explained, according to one theory, by the disappearance of menstruation which has a sedative effect on the tuberculous process; according to another theory, the hyperemia caused by irradiation may be the curative instance, whilst STEPHAN applies, in this field also, his hypothesis, quoted above, of an irritation of the cell function, by means of which the organism's powers of defence are put on the alert. WILMS assumes that a general influence takes place by means of immunization. VOGT, again, considers a direct irritative influence on the cellular protoplasm more probable.

Technique of Treatment. VOGT advises large areas with long distances (50 cm. focal distance) and a dosage of 50 % H. E. D., suitably given fractionized. In castration, he makes use of a shorter distance, 30 cm., and gives one field on the front- and one on the back side of the pelvis, each of 10×15 cm. size; the filters used are 0.5 zinc + 4 mm. aluminium.

WEIBEL also gives this dosage, but considers it indifferent if several smaller or a couple of larger fields are used.

JÜNGLING, again, advises in conclusion to his opinion mentioned above, smaller doses of 10—20 % H. E. D. as probably suitable and especially because they involve the possibility of retaining the ovarial functions.

I am entirely without any personal experience in this scope, but with regard to technique I wish, in consideration of the experience concerning the X-ray treatment of tuberculosis I am otherwise in possession of, to take the same standpoint as JÜNGLING.

D. Laryngeal Tuberculosis

The first attempts to influence laryngeal tuberculosis by X-ray therapy are met with in literature as early as 1905 (WINKLER, TURNURE, POYET and MÉNARD). WINKLER had treated 11 cases and observed a palliative effect of the treatment, which was confirmed by POYET and MÉNARD in their four cases. A few years later, BRÜNINGS and ALBRECHT (1909) reported that they, on X-ray irradiation of experimental laryngeal tuberculosis in rabbits, were able to de-

monstrate encapsulation of the foci by means of fresh connective tissue and regression of the process. Later on, SCHULZ, WILMS, MENZER and WETTERER have published solitary cases, in which they have managed to bring the tuberculous process to a standstill or to a cure with the help of X-ray treatment.

First during the last decennary have these attempts, however, been followed by reports, based on larger clinical experience and a suitably arranged Roentgen technique. The basis of the entire question of X-ray treatment of laryngeal tuberculosis is that this process almost always appears as a consequence of lung tuberculosis and that the nature and development of this disease exerts a determining influence on the character and prognosis of the laryngeal tuberculosis.

On this account, great interest has also been shown for the treatment of tuberculous laryngitis in the institutions where X-ray treatment of lung tuberculosis is practised. Thus we have from BACMEISTER's sanatorium at St. Blasien, a work by RICKMANN, concerning the results obtained there (1922).

Firstly RICKMANN emphasizes that the X-rays must be considered as only one remedy among those which ought to be used, and that surgical, chemical and hygienic-dietetic resources ought on no account to be missing.

Further, the indications for X-ray therapy ought to comply with the anatomical character of the tuberculous process. Exudative and acute destructive forms are not suitable for this treatment, nor yet cases in which perichondritis has already appeared, but only the preponderatingly productive forms with subepithelial tubercles and submucous tuberculous infiltration. Ulcers tending to decomposition may, on the contrary, be increased in size by irradiation instead of being healed.

Twelve cases which have got cured by X-rays only, have been treated at the Institute, further 49 cases which have got chrysolgan locally besides, of which 10 are cured or improved, and 22 cases which have undergone as well X-ray treatment as surgical operations and which also show extremely good results. Only in 10 cases have the results been poor, in 8 the condition has even become worse (exudative forms with ulceration and perichondritis).

The first to be mentioned among other authors in this scope is BECK, who appears to share RICKMANN's opinion as to the indications for X-ray treatment. He prefers to use the "constructive", not the "destructive" effect of the X-rays, which partly arrests the development of the tuberculous granulation tissue, partly promotes the formation of connective tissue, and recommends a strict individualization which takes into consideration not only the local state but also

the general condition and the lung process. Besides the X-rays he also makes use of chrysolgan locally together with general hygienic treatment.

DEBICKI, again, wishes to extend the indications even to the destructive and ulcerous cases. Admitting that a cure is most easily obtained in initial, circumscript forms, he nevertheless has seen even severe, destructive changes get cured in 4 cases. Transient impairments may take place, but do not, of necessity, prevent a favourable issue. DEBICKI has not met with any serious Roentgen lesion of the larynx, only a transitory edema in one case. Concerning the nature of the X-ray effect he agrees with RITTER's and MOJE's above mentioned opinions.

Out of the 19 patients irradiated by DEBICKI, 6 broke off the treatment in its earliest stage. Of the remaining 13, 5 were cured, 4 of whom were to be considered as very serious cases. All were treated with X-rays *only*, and the diagnosis was confirmed as well bacteriologically as histologically.

BECK has treated not less than 200 cases, of which 13 got X-rays only; all had bilateral lung tuberculosis. Three of these got worse, 3 somewhat improved and 7 cured, of which 4 had an open and 3 a closed laryngeal tuberculosis.

Concerning the *technique* in larynx treatment, RICKMANN recommends doses of 8—10 X with a focal distance of 24 cm and 4 mm Al-filter, given on 3 areas, 4 cm in diameter, one in front and one on each side. Such a series is given during a week, with irradiation every other day, and is repeated the following week, after which there is an interval of 3 weeks. This treatment can be repeated several times. Ulcerative forms require smaller doses and larger intervals.

BECK gives $^2/_3$ H. E. D., filtered through 3 mm of Al, on 2 areas with crossing in the centre, estimating that the larynx receives in this manner 40—60 % H. E. D. The treatment is repeated 5—6 times with intervals of 4—6 weeks.

Concerning DEBICKI, he describes his technique in the following way: Apex apparatus with S.H.S.-tube and a spark gap of 27 cm corresponding to a wave length of 0.15 Å. The dose is 5 H on 2 side areas, filtered through 4 mm of Al with a focal distance of 23 cm. The patient is placed on his back with his head reclined. An interval of 7 days is interposed between each area and of 4—6 weeks between 2 such series.

As I myself have no experience at all in X-ray treatment of laryngeal tuberculosis, I am unable to give any opinion upon it. Only this much ought to be said, that extreme care must be taken

with regard to dosage, considering the well known publications made concerning Roentgen injuries to the larynx, and further that BECK's doses appear to be decidedly larger than may be deemed appropriate. The same may be said about the above quoted indications of DEBICKI; the most rational way is surely to exclude, like RICKMANN, the ulcerative and destructive cases from X-ray treatment.

E. Tuberculosis of the Bones and Joints

I. General Remarks

Having at my disposal, at the Roentgen Institute at Lund, only a very limited material within this field having been X-ray-treated with such a consistence that the results allow an opinion on the special cases, and a more extensive criticism grounded on my own experience concerning the different groups of these ailments being thus impossible, I have been obliged to confine myself to a concentrated review of the most important points which a study of the literature appears to me to yield. Hereby, I have principally followed the clear and concise exposition of JÜNGLING.

To begin with, I want to emphasize that the X-ray treatment of these diseases in the greater number of cases can not be nor ought to be the only therapy, but only a link in the many-sided therapy which the present time demands. Bone and joint tuberculosis is, as well as and perhaps even more than all the other forms of so-called surgical tuberculosis, to be looked upon as a localization of a general tuberculous infection. Further on, the character of these diseases in many cases demands more or less extensive surgical operations on which account a surgically schooled judgment is necessary. Moreover, an orthopedic therapy, determinedly and consistently carried out, is often included as the most important moment in their treatment; therefore, the orthopedist ought undoubtedly to be the principal leader in the management of these diseases. Bone and joint tuberculosis is, by preference, a *surgical* tuberculosis.

Considering the development of radiology in the Scandinavian countries and especially in Sweden to an independent medical branch, which certainly is, from a general point of view, the most beneficial, it seems to be equally certain that X-ray treatment, in these cases, ought to be directed by the professional Roentgenologist and that consequently the patients are most benefited by an intimate and confidential co-operation between both these branches. This is especially necessary as the opinion on the rôle and indications of X-ray treatment for the different forms of surgical tuberculosis is still so varying.

Concerning the *historical development* of this therapy, I will be brief. KIRMISSON, as is known, was the first who (1898) brought a wrist tuberculosis to a cure by means of X-ray treatment. Later on, reports of solitary, similar attempts followed from RUDIS-JICINSKY, FREUND, VASSILIDES, WETTERER. However, within this province also, as well as with the tuberculous glands, it was the works of ISELIN that signified the breaking through of the new method of treatment (1910). His systematically treated material comprised 41 cases, out of which 24, or 58.5 % were cured. After ISELIN, this therapy was taken up by a great number of surgeons, orthopedists and radiologists, among whom may be mentioned BAISCH, SCHMERZ, SCHEDE, A. BECK, KÜTTNER, PERTHES, ALBERT-WEIL, BROCA and MAHAR, RAPP, VULPIUS and others.

On the whole these authors express themselves favourably as to the result of X-ray treatment. Experience has, however, gradually taught us that these results have not the same value in all localizations or in all the different forms or stages of tuberculosis, and also that age plays a certain rôle with regard to the effect of the irradiation. Further we must be prepared for the fact correctly emphasized by JÜNGLING, that the process of healing is very slow and is firstly marked by the disappearence of the symptoms of irritation, so that the process enters upon an indolent stadium. This is often marked by the breaking through of cold abscesses and formation of slack fistulae which only gradually close. In spite of the apparent cure, remains of the tuberculous processes may all the same be left in the deeper parts for a long time; therefore the case ought to remain under observation of both orthopedist and radiologist for several years, during which time the general hygienic treatment, sun or light therapy, baths, etc., ought also to be carried as far as possible. I cannot discuss these details any more.

An excellent means of following and controlling the course of the tuberculous process is given us by *radiography* which reveals eventual sequestration, in- or decrease of bone atrophy, healing out of the foci, the final sclerosis of the bones etc. In this manner a welcome completion of the clinical observation is won, by which it becomes possible int. al. to make the necessary operation at the right time, to localize a new focus etc.

Concerning the influence of *age*, it appears to be generally agreed upon that as far as possible a purely conservative treatment ought to be prevalent *among children*, and here X-ray therapy ought naturally to play an important rôle. With *old* people, over 50 years of age, the results of the large resections in tuberculosis are, as is known, very poor, and here the conservative treatment incl. X-ray

therapy will again get its rights, while the real field for surgery is to be found with middle-aged people. Here opinions are varying considerably in different clinics as to the mutual indications for conservative and operative treatment. Thus BIER hardly ever operates, but makes use of his methods of treatment above described. FR. KÖNIG has collected statistics of 1,932 cases of resections in primary bone and joint tuberculosis, out of which 1,329 still are alive and cured 5—20 years afterwards. As any larger statistics concerning the late results of conservative treatment in severe cases are still not available (1921), he considers it not advisable to abandon the operative method, which he, however, does not apply schematically; in certain severe joint cases, such as fungus, suppurating abscesses, bone destructions, he makes use of conservative principles, in suitable cases again he makes resection, afterwards adding orthopedic treatment.

At PAYR's clinic, on the contrary, radiotherapy is practised on a larger scale, and exudative forms without bone destructions are considered especially suitable (BAENSCH). No particular variations regarding the X-ray results with the different localizations have been noticed. Even fungous forms appear to answer very well to X-ray treatment.

HOLFELDER (SCHMIEDEN's clinic, Francfort) considers his results in cases of closed tuberculosis of bones and joints to be extremely good, only needing, on an average, 6—8 months to attain a cure. Mixed infections take a longer time, on an average 9—10 months. Fungous cases get cured without operation in most cases, focal bone destructions are operated upon and afterwards treated with X-rays in order to decrease the risk of recurrence.

LEXER warns against putting off the operation until the conservative treatment has proved a failure. If an operation is to be made, it must be done as radically as possible so as to exclude mixed infection. Therefore he operates as a matter of principle and reserves conservative treatment for children and cases with localization to small joints, but besides he gives radiotherapy the second place, as he prefers light treatment, above all "Höhensonne".

From PERTHES' clinic at Tübingen is reported by JÜNGLING that he has not found X-ray treatment very successful with ostitis tuberculosa multiplex. The diffuse, progredient bone tuberculosis also reacts badly (ISELIN). With regard to the tuberculosis of the joints, the dry, fibrous forms with spontaneous tendency to healing are in accordance to the reports of ISELIN considered as the most favourable; fair results have further been attained in fistulous cases with mixed infection, even really severe cases where formerly amputation was

the only course. Such affections, permeated by great quantity of lympho- and leukocytes, often become free from symptoms again in a few weeks; therefore an attempt ought always to be made with X-rays before proceeding to operation, provided precedence, on social grounds, is not given to amputation. Recurrences after resection also may be irradiated with favourable results.

JÜNGLING further remarks, not without surprise, that X-ray treatment of the affections of the small joints shows much better results than of the larger ones, without being able to explain why.

As far as the functional result is concerned, it is dependent upon the extension of the destructions present, and also upon the effectivity of the orthopedic therapy.

The risks of X-ray treatment in bone and joint tuberculosis are in cases of erroneous dosage greater and more fatal than in other localizations of this disease, and thus it is of very great importance here to keep the doses under the dangerous limit.

Direct, acute dermatitis through local over-dosage on the skin hardly ever occurs nowadays and can be passed by. On the other hand, partly owing to the small diameter of the extremities, and partly also on account of poorer circulation (especially in the hands, feet and lower legs) *secondary injuries* may not seldom appear which can arise without ever a dose of 1 H. E. D, or even $^2/_3$ of it having been given at once.

Already after irradiation of, for instance, a lower leg for an ulcerating skin tuberculosis or a bone focus with fistulae, with a dose of 60 % H. E. D. from 3 or 4 sides and a filter of 4 mm Al or $^1/_2$ mm zinc, a permanent pigmentation can arise, followed a couple of months afterwards by a chronic indurative edema, which never will quite disappear again. A secondary skin atrophy usually appears instead, making itself known by a diminished volume of the extremity at this place, with sharp margins corresponding to the irradiated area. Larger doses or greater susceptibility of the area in question can result in a larger or smaller degree of skin atrophy and eventual secondary Roentgen ulcerations.

A further fatal consequence, drawn attention to by JÜNGLING is, that too strong an irradiation of tuberculosis of the extremities often may lead, not only to no improvement of the affection but even to an impairment, as pain often will return after irradiation. Further, a continuation of the treatment is excluded by such an overdosage, and even operations, amputations or resections, within such altered regions are rendered more difficult. That even circumscribed bone necroses may occur, is shown in a case of tuberculosis of the knee joint, reported by PERTHES and quoted by JÜNGLING; the knee was

irradiated 4 times in the course of 6 months, with a homogeneous dose of 1 H. E. D.; afterwards it was obliged to be resected and showed then severe changes of circulation and partial necroses of the bone.

Technique of treatment

In consequence of these conditions, a careful dosage in bone and joint tuberculosis is of absolute necessity.

JÜNGLING recommends therefore his carefully composed method of homogeneous irradiation, with embedding of the extremities by means of radioplastin, filtration with 1/2 mm zinc and 3 mm Al, and total depth doses of between 10 and 50 % H. E. D., the latter only with old torpid cases and as the furthest limit for dosage upwards. For children the total dose must not exceed 30—40 % H. E. D., in severe cases with mixed infection only 10—30 % must be given. The intervals between irradiation amount to 6—8 weeks, and not more than 8 such series of treatment may be given in one year.

HOLFELDER only gives 30—40 % H. E. D., STEPHAN 10 % and KOHLER only 3—5 %. HOLFELDER uses distance irradiation to a great extent, with a focal distance of 1 meter; in this way 3—6 patients can be treated at the same time, lying besides each other within the compass of the large radiation area.

BAENSCH's treatment is given on the same principles as JÜNGLING's. MOLL irradiates thicker parts of the extremities from 4 sides, smaller only from 2, and gives 25 X on each area every 3rd or 4th week. A. BECK does not make use of the embedding method, considering that the purpose may be attained without it, if only the doses are kept small and the different cases carefully individualized. With too large doses, the results will get worse.

Here at Lund, I have, partly from lack of time, partly on account of the experience I have of irradiation of tuberculosis of other regions and forms, not considered it necessary to introduce the exact homogeneous irradiation according to JÜNGLING, but have found it sufficient to give the treatment from 2, 3 or 4 sides, depending upon the size of the parts concerned, with a dose on each area of 1/3, 1/4 or 1/5 H. E. D., 4 mm Al and a focal distance of formerly 20—25, nowadays usually 30 cm. For very deep-lying processes (hip joints etc.) a filter of 1/2 mm zinc has of late been used. With spina ventosa and as a rule with children the special doses have not exceeded 1/5 H. E. D. The results have been favorable, as far as they, on account of the irregularity of the treatment, could be judged. I have not observed any damages to the skin or deep secondary lesions in these cases, only now and then permanent pig-

mentations. The process of healing has in all cases been controlled by iterated roentgenograms. Simultaneous orthopedic and also, in many cases, sun-, bath- and general treatment have been given at the same time, and consequently, it has offen been very difficult to decide in how far the results ought to be attributed to X-rays.

II. X-ray Treatment in Different Localizations of Tuberculosis of the Skeleton

a. Bone tuberculosis

The form of bone tuberculosis in a strict sense, which has the greatest clinical importance, being the most common of all, is the *spina ventosa*. From a roentgenological point of view also it is very important, because it, judging from the statements of most authors, gives the best prognosis with X-ray treatment. WETTERER, A. BECK, MÜHLMANN, BROCA and MAHAR, MOLL, KOENNEKE, HÖRNICKE and others are all of this opinion. My cases have also reacted comparatively quickly and well, both the closed processes and those with fistulae and purulent secretion.

As to the tuberculous abscesses of the walls of the chest, which are usually diagnosed as *rib tuberculosis*, they do as a rule, according to ISELIN, not arise from a primary caries of the ribs, but from pleural foci with secondary arrosion of the ribs. Therefore, operation is mostly not indicated in these cases, and even X-ray treatment is often not to be recommended as it is not quite certain that the primary focus can be comprised in the irradiation area.

Attempts to find out the extension of the fistulae present by means of injecting contrasting matter, as proposed by JÜNGLING, may often give uncertain results as to the size of the irradiation area. If this is large, it may not be altogether without risk giving X-ray treatment repeatedly on the chest, especially if, as is often the case, lung tuberculosis is present. Small doses of 10—20 % H. E. D., according to circumstances, are at all events indicated. MOLL, MÜHLMANN, BECK, HOLFELDER report favourable results, especially with distance irradiation. The special treatment which ought, first of all, be thought of here, is nevertheless general light baths, either with arc light or quartz light.

Regarding further the *tuberculous spondylitis*, the general opinion nowadays appears to be in favour of X-ray treatment as an auxiliary method, although it is, of course, not possible to judge what rôle it does really play in the many-sided treatment to which these affections are subjected. The danger once pointed out by ISELIN, namely the sinking abscesses getting hot because of X-ray treatment, is, according to HOLFELDER's opinion, apparently not to be feared, pro-

vided the doses are kept sufficiently low. LEXER recommends X-ray treatment with very small doses, 3—4 % H. E. D., in accordance with the technique of KOHLER; BAENSCH has also obtained favourable results both with caries of the ribs and spondylitis, the duration of treatment being considerably shortened by X-raying. With spondylitis he gives 2 areas from the back and one from the front. JÜNGLING warns against keeping the total dose higher than 30 % H. E. D. and prefers to give only one single area — from behind — and from a long distance.

With *ileosacral tuberculosis* he makes use of the same technique, the results being, according to his own opinion, favourable.

b. Joint tuberculosis

Wrist tuberculosis appears to be one of the most suitable forms for X-ray treatment, and still more favourable as the operative treatment mostly, according to GARRÉ, gives an extremely poor prognosis. Thus, ISELIN has 69 % cured by X-rays in this affection, PETERSEN and HELLMAN (Kiel) 71 %. MOLL has attained healing in 18 out of 33 cases, A. BECK has reported 25 cured out of 26, among which were 11 fistulous cases with 9 cures.

WETTERER regards the closed forms of wrist tuberculosis as one of the most favourable localizations as to X-ray treatment. JÜNGLING has also gained fairly good results since he began with a cautious dosage (20—23 % H. E. D. from 2 sides, embedding method). He prudently emphasizes that it is very difficult to decide from which time complete cure may be considered to have taken place, and therefore prefers only to talk of a "stadium without irritation". Out of 22 cases 15 (= 68.2 %) have become free from symptoms in this way, 5 (22.7 %) improved, the other 2 unimproved. Among the 15 named, 2 later on had relapses. Such things may happen, even after 5 years of apparent health, as is shown by one of JÜNGLING's cases.

As far as the *functional ability* is concerned, complete function was attained in 6 of these cases, a medium function in 7, while 4 healed with a stiff joint. Different *forms* of tuberculosis do not appear to show any special variation as to radio-sensibility, although reports in this respect are extremely varying.

The *time* required for attainment of such results can not be exactly stated, as it varies from 2—5 up to 8 months, sometimes even longer. A professionally conducted orthopedic treatment is, of course, indispensable during the whole time.

Elbow tuberculosis shows good results with an operative treatment; according to KÖNIG's above mentioned collected statistics, 143 cases got finally cured (51 %) out of 220, of which 74 afterwards died.

However, radiological treatment has likewise shown very good results. ISELIN thus reports a number of not less than 72 % of his cases, cured exclusively by X-ray treatment. PETERSEN has 47.8 %, A. BECK 14 cases of closed tuberculosis with 8 cured, 14 of fistulous nature with 6 cured (50 %). WILMS has given up resection more and more, and instead uses X-rays, sometimes combined with arthrectomy. At PERTHES' clinic no resections are performed nowadays since the introduction of a systematic X-ray therapy. JÜNGLING reports statistics of 31 cases from the time after 1919, out of which 22 (70.8 %) are apparently cured; 15 of them had been controlled at least for 3 years. Complete functional ability was attained in 15 cases, medium function in 3 and ankylosis in 7 cases. The greater number were middle aged persons, several were severe cases with fistulae.

Tuberculosis of the shoulder joint, most usually appearing under the form of caries sicca, is generally considered to be a favourable field for X-ray therapy. In accordance with JÜNGLING, I here first quote the figures from KÖNIG's collected statistics of resections of the shoulder joint: out of 105 cases 75 were after-examined, of which 57 (= 76 %) were finally cured; later on, 29 died.

Concerning the results of X-ray treatment, PETERSEN and HELLMAN had 11 cases, all cured except one. From PERTHES' clinic 12 cases are reported, of which 5 are apparently cured, 3 improved, 2 unimproved and 2 recurrences. BECK has 11 cases of which 10 were cured by X-rays. In spite of a long lapse of time — fistulous cases may take several years before healing — JÜNGLING advises X-ray treatment in all cases where large sequesters do not make a radical surgical operation necessary. The orthopedic treatment is a conditio sine qua non.

Tuberculous coxitis is as a rule conservatively treated, in accordance with orthopedic rules, resection is only performed in extreme cases. Out of the 427 resection cases collected by KÖNIG, 335 were after-examined, of which 73 later died, the remaining 207 (62 %) were cured.

From statistics concerning X-ray treatment of tuberculous coxitis, I may quote BECK's, who treated 13 fistulous cases, of which 5 were cured; further PETERSEN's and HELLMAN's 13 cases (all fistulous) with 4 cured, 4 improved, 1 unimproved and 3 deaths.

Regarding the *technique* it has to conform to circumstances; processes, confined to the joint, ought in accordance with JÜNGLING's proposal to be irradiated from 2 sides, while cases with extensive formation of fistulae ought to be irradiated in large areas at a long distance.

Knee joint tuberculosis appears, as is well known, in 3 different clinical forms: hydrops, fungus and suppurative, fistulous tuberculosis. Concerning the treatment, it is necessary to distinguish between tuberculosis in children, which is generally treated absolutely conservatively, and tuberculosis in adults.

As far as the *operative* results of this so common disease are concerned, the statistics from v. BRUN's clinic show 87.9 %, from GARRÉ's clinic 65 % and the collected statistics of KÖNIG, comprising 983 post-examined cases, 714 (72.6 %) cured, thus really good results, although gained at the expense of the joint.

As to X-ray treatment again, already ISELIN warns against the irradiation of fungous cases, owing to the poor results he has got, and which he ascribes to the difficulty of attaining sufficient depth doses with the rays of those days. This reason is certainly no more actual, but the results appear, nevertheless, to be unsatisfactory.

Thus, PETERSEN and HELLMAN have out of 62 cases (children and young people under 20 years of age) been successful in attaining an apparent cure in 41 cases, while out of 15 adults only 8 were cured.

JÜNGLING has treated 120 tuberculous cases, mostly adults, and has obtained an apparent cure only in hydrops. In fungous cases again, a certain improvement with relief from pain is common, but often a slight swelling of the capsule will remain. The power of motion will usually decrease still more, consequently it is impossible to speak of any cure and the risk of recurrence is still present. These recurrences will easily be malignant and amputation must be resorted to. On this account, JÜNGLING agrees with ISELIN's opinion just named. Concerning the suppurating cases again, they ought according to JÜNGLING to be treated with X-rays, likewise the recurrences after resection and cases over 50 years of age, in which resection gives a worse result.

HOLFELDER does not speak of such a reduction of the indications. A. BECK reports that in X-ray treatment of 91 cases of closed knee joint tuberculosis, he has had 51 cured, among 7 fistulous cases, 5 cured and considers the question of treatment method in a high degree dependent on social indications. MOLL has 29 cases of which 17 were cured, 4 improved and 5 less good, although painless cases (could walk with the help of a splint bandage). He regards knee joint tuberculosis as very specially favourable to X-ray treatment, an opinion which surely allows of a modification.

The reason for this striking difference from the X-ray results with the joints of the upper extremities is possibly to be found in the mechanical irritation of the joint when walking (in spite of the splint bandage), perhaps also in a less favourable state of circulation.

Tuberculosis of the tarsus and ankle joint. Tuberculous affections of the calcaneus appear as a rule to remain as isolated bone foci, while the foci of the talus are prone to spread themselves to the ankle joint and other joints; this is also the case with tuberculosis of other tarsal bones.

According to DIETRICH, isolated bone foci ought to be operated upon and post-irradiated in order to hasten healing.

As far as regards tuberculosis of the talocrural joint and of other joints of this region, the situation appears to prove that conservative treatment is of little use. GARRÉ has conservatively treated 222 cases of which 114 with a bad result, it being necessary to operate afterwards. The results of resection are good in young people — cures in 75 % of the total number of cases — in adults, on the contrary, only 53 %, on an average good results in 61 %. In KÖNIG's collected statistics 276 resected ankles have been examined, of which 39 later died. The remainder, 174 cases (= 66.4 %) were cured.

On the other hand, ISELIN reports 64 % cures and 24 % deaths, among 55 of his cases after-examined at least one year after treatment. PETERSEN and HELLMAN have 61 cases with 35 cures; 37 of these were under 20 years of age and 25 of them were cured, while 24 were over 20 years old and only 10 of these got cured. Here also the best results were obtained in closed cases.

JÜNGLING emphasizes that he has seen many fungous ankle tuberculoses, even bad cases, get apparently cured by X-ray treatment and that, on this account, the resections in PERTHES' clinic have been greatly reduced of late years, in favour of not only X-rays but also of amputation, social conditions playing an important rôle here.

HOLFELDER prefers to irradiate ankle joint tuberculosis, likewise MOLL. BECK, on the contrary, has got worse results here than in other regions. He has got 34 cures out of 49 cases of closed tuberculosis; out of 24 fistulous cases, 9 were cured. He warns against X-ray treatment of such cases in older people.

It is understood that also here the orthopedic treatment is indispensable to obtain good results.

SUMMARY

The author dwells at first on the different theories concerning the nature of the influence of the X-rays on tuberculous affections: the bactericidal, directly and indirectly by influence on the surrounding tissues, further on their influence on the tuberculous tissue itself by cell destruction on one side and perhaps irritation of connective tissue to organization on the other. Regarding the irritative effect of the X-rays supposed by STEPHAN and KOHLER

the author is very doubtful, and the autotuberculinization theory of ISELIN is not supported by him.

As to the X-ray treatment of special localizations of tuberculosis the author has personal experience principally about tuberculous glands and tuberculous peritonitis.

Regarding tuberculous glands, firstly some historical points are given. and the author shows how X-ray treatment has, since about 1910, gradually taken the place of surgery. In diagnosing tuberculous glands, one should have in mind as well lymphosarcoma, lymphogranuloma and lues as especially chronic glandular affections of a septic origin, very like tuberculosis. The author divides the tuberculous lymphadenitis into 3 different forms, viz. 1) simple hyperplastic glands, 2) glands with diffuse periadenitis, and 3) suppurating, fistulous or ulcerated glands, and describes the effect of X-rays in these different groups. His own material comprises a total of 270 cases with 73 % cured, 14,8 % improved, 8,5 % recurrences and 3,7 % deaths.

Having discussed the X-ray treatment in comparison with the results of surgery, the author now proceeds to the development of technique with different authors and warns expressly against the large doses recommended especially by some German authors in connection with the breaking through of the modern deep therapy. The author maintains that the X-ray injuries occasioned by such dosage, must and can always be avoided by a prudent and cautious technique. In connection with this, the proposal of REYN to replace the X-rays by light treatment, is met with some criticism from the author who, on the other hand, recommends a combination of these two agents for certain cases. Lastly, the author's indications for X-ray treatment of glands are given.

Regarding tuberculous peritonitis, the author gives some historical facts as to the results of surgery compared with those of X-ray therapy and quotes different reports of this treatment. His own material comprises only 13 cases, partly surgically treated as well as radiologically, with mostly good results. In total judgment, it may be said that X-ray treatment has greatly improved the prognosis with exudative cases and is able to give very good results also with adhesive and purulent-ulcerous forms where surgery is unfavorable.

The rest of the work includes the urogenital tuberculosis, the laryngeal tuberculosis and the tuberculosis of the bones and joints. The author's personal experience with X-ray treatment of such affections being none or very poor, he has, in these provinces, limited himself to give an account of the principal literature und results of different radiologists.

ZUSAMMENFASSUNG

Der Autor berührt zuerst die verschiedenen Theorien über die Natur des Einflusses der Röntgenstrahlen auf die tuberkulösen Affektionen: 1) die Theorie der bakteriziden Wirkung, direkt und indirekt durch den Effekt auf die umgebenden Gewebe; 2) die Theorie der Beeinflussung des tuberkulösen Gewebes selbst, einerseits durch Zelldestruktion und anderseits vielleicht durch Anregung des Bindegewebes zur Organisation. Der von STEPHAN und KOHLER supponierte irritative Effekt der Röntgenstrahlen ist dem Verf. sehr zweifel-

haft, und auch der Autotuberkulinisationstheorie von ISELIN kann er sich nicht anschliessen da sie bis jetzt ganz unbewiesen ist.

Hinsichtlich der Röntgenstrahlenbehandlung der einzelnen Tuberkulose-lokalisationen hat Verf. besonders über diejenige tuberkulöser Drüsen und tuberkulöser Peritonitis persönliche Erfahrungen.

Was die tuberkulösen Drüsen betrifft, werden zunächst einige historische Momente erwähnt, und es wird gezeigt, wie die Röntgenbehandlung ungefähr seit 1910 allmählich an die Stelle der chirurgischen trat. Bei der Diagnose der tuberkulösen Drüsen muss man auch die Lymphosarkome, Lymphogranulome und Lues, sowie besonders chronische Drüsenaffektionen septischen Ursprungs im Auge behalten, die der Tuberkulose sehr ähneln.

Verf. teilt die tuberkulöse Lymphadenitis in 3 verschiedene Formen — 1) einfach hyperplastische Drüsen, 2) Drüsen mit diffuser Periadenitis und 3) vereiternde, fistulöse oder ulzerierte Drüsen — und beschreibt die Wirkung der Röntgenstrahlen auf diese verschiedenen Gruppen. Sein eigenes Material umfasst eine Gesamtzahl von 270 Fällen mit 73 % geheilten, 14.8 % gebesserten, 8.5 % Rezidiven und 3.7 % Todesfällen.

Nach Erörterung der Röntgenbehandlung im Vergleich zu den Resultaten der chirurgischen geht Verf., unter Erwähnung verschiedener Autoren, auf die Entwicklung der Technik über und warnt ausdrücklich vor den grossen Dosen, die besonders von deutscher Seite her im Zusammenhang mit dem Durchbruch der modernen Tiefentherapie empfohlen wurden. Verf. ist der Ansicht, dass die durch solche Dosierung verursachten Röntgenschädigungen durch eine rationelle und vorsichtige Technik immer vermieden werden können und müssen. Bei dieser Gelegenheit stellt er sich dem Vorschlag REYNS, die Röntgenstrahlen durch Lichtbehandlung zu ersetzen, etwas kritisch gegenüber und empfiehlt seinerseits für gewisse Fälle eine Kombination dieser beiden Mittel. Schliesslich folgen die Indikationen des Verf. für die Röntgenbehandlung der Drüsen.

Betreffs der tuberkulösen Peritonitis bringt Verf. einige historische Daten über die Resultate der chirurgischen, verglichen mit denen der Röntgentherapie, und zitiert verschiedene Berichte über diese Behandlung. Sein eigenes Material besteht nur aus 13 Fällen, die teilweise sowohl chirurgisch als radiologisch behandelt wurden, meist mit gutem Erfolg. Zusammenfassend kann gesagt werden, dass die Röntgenbehandlung die Prognose bei exsudativen Fällen erheblich gebessert hat, und dass sie auch bei adhäsiven und purulent-ulzerösen Formen, wo die chirurgische Behandlung ungünstig ist, sehr gute Resultate zu geben vermag.

Der Rest der Arbeit beschäftigt sich mit der Urogenital-, der Larynxtuberkulose und der Tuberkulose der Knochen und Gelenke. Da Verf. über die Röntgenbehandlung dieser Affektionen keine oder sehr geringe persönliche Erfahrungen hat, beschränkt er sich darauf, einen Bericht über die wichtigste Literatur und die Resultate verschiedener Radiologen auf diesen Gebieten zu geben.

RÉSUMÉ

L'auteur rend compte tout d'abord des diverses théories émises sur le mécanisme de l'action des rayons X sur les affections tuberculeuses: action bactéricide, directe ou indirecte, par influence sur les tissus environnants,

action sur les tissus tuberculeux eux-mêmes, par destructions cellulaires d'une part, et peut-être aussi par irritation organisative du tissu connectif. L'auteur est fort sceptique sur l'action irritative des rayons X, soutenue par STEPHAN et KOHLER, et il rejette entièrement la théorie de l'autotuberculinisation soutenu par ISELIN comme une hypothèse pas prouvée.

En ce qui concerne le traitement radiologique des localisations tuberculeuses spéciales, l'auteur a acquis sur ce sujet une certaine expérience personnelle, notamment en ce qui touche la tuberculose ganglionnaire et péritonéale.

Au sujet de la tuberculose ganglionnaire, l'auteur expose d'abord quelques points historiques de la question: il fait valoir que la radiothérapie a, depuis 1910 environ, progressivement évincé le traitement chirurgical. Dans le diagnostic de la tuberculose glandulaire, il convient de songer aussi bien au lymphosarcome, au lymphogranulome, à la syphilis ainsi qu'aux affections ganglionnaires chroniques d'origine septique, si ressemblant à la tuberculose.

L'auteur divise la lymphadénite tuberculose en trois groupes: 1) hyperplasie ganglionnaire simple, 2) ganglions avec périadénite diffuse, 3) ganglions suppurants, fistuleux et ulcéreux, et indique l'action des rayons X sur ces divers groupes d'affections. Son matériel clinique comprend à l'heure actuelle 270 cas, avec 73 % de guérisons, 14.8 % d'améliorations, 8.5 % de récidives et 3.7 % d'issues mortelles.

Après avoir discuté les résultats du traitement radiologique comparés à ceux du traitement chirurgical, l'auteur rend compte en détails de la technique préconisée par différents cliniciens; il met expressément en garde contre les fortes doses recommandées spécialement par certains auteurs allemands en connection avec l'avènement de la thérapeutique moderne profonde. Il affirme que les lésions radiothérapiques déterminées par de telles doses peuvent parfaitement être évitées avec une technique plus prudente et moins brutale. A ce propos, l'auteur expose son scepticisme critique sur la substitution proposée par REYN de la photothérapie à la radiothérapie et recommande d'autre part une combinaison de ces deux méthodes dans certains cas. Enfin, il donne les indications de la radiothérapie dans les affections ganglionnaires.

En ce qui concerne la tuberculose péritonéale, l'auteur communique quelques points historiques touchant les résultats du traitement chirurgical comparés à ceux que donne la radiothérapie. Son matériel clinique actuel comprend seulement 13 cas, dont certains ont été soumis au traitement chirurgical et au traitement radiothérapique, avec très bon résultat. En somme, on peut affirmer que le traitement radiologique a notablement amélioré le pronostic des formes exsudatives et qu'il est susceptible de donner également d'excellents résultats dans les formes à adhérences ou ulcèro-suppuratives, formes dans lesquelles le traitement chirurgical reste peu efficace.

Le reste de ce travail concerne la tuberculose urogénitale, la tuberculose laryngée et la tuberculose des os et des articulations. L'expérience personnelle de l'auteur à cet égard étant nulle ou très restreinte, il se contente de rendre compte des principales indications bibliographiques et des résultats atteints par divers radiologistes.

LITERATURE

ALTSCHUL: Strahlentherapie Vol. XIX, p. 505.
BAENSCH: Strahlentherapie Vol. XVIII, p. 517.
BAISCH: Ergebnisse d. Chir. u. Orthop. Vol. VII, p. 110.

BARJON: Comptes rend. du Congr. de l'assoc. franc. pour l'avancement des Sc. 1908 (Abstr. Arch. d'Electr. 1908, p. 614).
BARJON: Arch. d'Electr. méd. 1910, p. 205.
BECK, A.: Strahlentherapie Vol. XIX, p. 199.
BECK, K.: Münch. M. Woch. 1923, p. 1454.
BERGONIÉ: Arch. d. Electr. méd. 1905, p. 300.
» et SPÉDER: Arch. d'Electr. méd. 1911, N:o 306.
» et TEISSIER: Arch. d'Electr. méd. 1898, p. 336.
BIER: Münch. M. Woch. 1921, p. 243.
BIRCHER: Strahlentherapie Vol. XI, p. 646.
BLOS: Quot. from VOELCKER: Die Chir. d. Halses, Handb. d. prakt. Chir., Vol. II, p. 98, Berlin 1924.
BORCHGREVINK: Mitteil. a. d. Grenzgeb. Vol. VI, p. 434.
BRASSER: Quot. from JÜNGLING, Röntgenbeh. Chirurg. Krankh., p. 388, Leipzig 1924.
BROCA et MAHAR: Strahlentherapie Vol. IV, p. 261.
» Fortschr. a. d. Geb. d. Röntgenstr. Vol. XXI, p. 425.
BRÜNINGS u. ALBRECHT: 16. Versamml. d. Vereins deutsch. Laryngol. (Abstr. Fortschr. a. d. Geb. d. Röntgenstrahlen Vol. XIV, p. 139.)
CULLOCK: Arch. of the Roentg. Ray. Vol. XI, 1907, p. 312.
DEBICKI: Strahlentherapie Vol. XVIII, p. 161.
DEYKE u. MUCH: Quot. from JÜNGLING, Röntgenbeh. Chir. Krankh., p. 374.
DIETERICH: Strahlentherapie Vol. VI, p. 214.
DISSON: Strahlentherapie Vol. X, p. 307.
DOWD: Quot. from VOELCKER: Die Chir. d. Halses, Handb. d. prakt. Chir. Vol. II, p. 99, Berlin 1924.
EDLING: Acta Radiolog. Vol. I, p. 455.
FINKELSTEIN: Quot. from VOELCKER, l. c.
FÜRNROHR: Ibid.
FRANK: Mitteil. a. d. Grenzgeb. Vol. VI, p. 97.
FREUND: Münch. m. Woch. 1909, N:o 41.
GARDINER: Scott. med. and Surg. Journ. II, 1908 (Abstr. Fortschr. a. d. Geb. d. R.-strahl. Vol. XII, p. 437).
HABERLAND u. KLEIN: Münch. m. Woch. 1921, p. 1049.
HEINEKE: Zbl. f. Chir. Vol. 78, p. 196.
HOLFELDER: Strahlentherapie Vol. XII, p. 101.
» Med. klinik 1922, p. 1325 and 1353.
HOLZKNECHT: Arch. f. Derm. u. Syph. Vol. LXVI, H. 1—2.
» Röntgenologie, Vol. II, H. 2, p. 202, Berlin-Wien, 1924.
HÖRNICKE: Münch. m Woch. 1923, p. 943.
ISELIN: Deutsche Zschr. f. chir. Vol. 103, 1910.
» Corresp.blatt f. Schw. Ärzte, 1912, p. 729 and 879.
» Strahlentherapie Vol. X, p. 673.
JOHNSTON: Amer. Electrotherap. Assoc. Oct. 1905. (Abstr. Fortschr. a. d. Geb. d. Röntg.strahlen Vol. XIV, p. 68.)
JÜNGLING: Strahlentherapie Vol. XIV, p. 761.
» Röntgenbeh. Chir. Krankh. Leipzig 1924.
KIENBÖCK: Arch. d'Electr. méd. 1910, p. 257, 323.
KNOX: Arch. of Radiol. Vol. XXI, 1916—17, p. 27.
KOENNECKE: Ther. d. Gegenwart, 1922, p. 139, 172.
KOHLER: Münch. m. Woch. 1919, p. 634.

König, Fritz: Verh. d. deutsch. Ges. f. Chir. Vol. 45, II, p. 79, 1921.
» » : Münch m. Woch. 1921, p. 642.
Krall: Naturhist. med. Verein. Heidelbg. (Abstr. Münch. m. Woch. 1912, N:o 3.)
Krecke: Bruns' Beitr. Vol. 95, p. 609.
Küpferle u. Bacmeister: Deutsche m. Woch. 1913, N:o 33 and 1916, N:o 4.
Küttner: Versamml. deutsch. Naturf. u. Ärzte, 1912.
Lang: Strahlentherapie Vol. XIV, p. 125.
Lexer: Deutsche m. Woch. 1921, p. 821.
Lüdin: Schweiz. m. Woch. 1922, p. 1081.
Martius: Fortschr. a. d. Geb. d. R-strahlen, Vol. XXXII, Kongressheft II, 1924, p. 21.
Menne: D. Zschr. f. Chir., Vol. 123, 1913, p. 357.
Menzer: Strahlentherapie Vol. IX, p. 217.
Moll: Bruns' Beitr. Vol. 118, p. 445.
Most: Chir. d. Lymphgefässe u. d. Lymphdrüsen, Stuttgart 1917.
Mühlmann: Ther. Monatsh. Vol. 34, $^{15}/_{1}$ 1920.
Müller, W.: Zschr. f. Tuberkulose, Vol. 28, 1917, p. 95.
Neve: Quot. fr. Voelcker: Die Chir. d. Halses, Handb. f. prakt. Chir. Vol. II, Berlin 1924. p. 99.
Pagenstecher: D. Zschr. f. Chir. Vol. 67.
Pancoast: Therapeut. Gaz. 1905, Aug. 15. (Abstr. Fortschr. a. d. Geb. d. R-strahl. Vol. IX, p. 405.)
Perthes: Ther. d. Gegenw. 1912, H. 10—11.
Petersen: Strahlentherapie, Vol. IV, p. 272.
» u. Hellmann: D. Zschr. f. Chir. Vol. 185, H. 3, 4.
Peyser: Bruns' Beitr. Vol. 122, p. 656.
Pfahler: Therapeut. Gaz. Jan. 1904, 1905.
Poyet et Ménard: Bull. méd. $^{5}/_{10}$ 1910. (Abstr. Münch. m. Woch. 1910, p. 1953.)
de Quervain: Sem. méd. 1912, p. 433; 1913, N:o 23.
Rapp: Strahlentherapie, Vol. X, p. 290.
Redard: Arch. d'Electr. méd. 1905, p. 931.
Reyn: Acta Radiol. Vol. III, p. 455.
Rickmann: Münch. m. Woch. 1922, p. 1572.
Ritter u. Moje: Strahlentherapie, Vol. XV, p. 283.
Bose: Mitteil. a. d. Grenzgeb., Vol. VIII, p. 11.
Rudis-Jicinsky: N. Y. and Philad. med. Journ. 1904. (Abstr. Fortschr. a. d. Geb. d. R-strahl. Vol. IX, p. 70.)
Runström: Acta Radiol. Vol. III, p. 486.
Schede: Zschr. f. Orthop. Chir. Vol. XXI, p. 497.
Schmerz: Bruns' Beitr. Vol. 81, p. 634.
Schmidt: Quot. fr. Baisch, l. c.
Schröder: Lehrb. d. Gynäk. Leipzig 1922, p. 307.
Schwarz: Quot. fr. Baisch, l. c.
Seitz u. Wintz: V. Sonderb. zu Strahlenther., Berlin-Wien 1920, p. 416.
Shattuck: Amer. Journ. m. Scienc. 1902.
Stark: Strahlentherapie, Vol. XII, p. 301, 1024.
Stephan: Strahlentherapie, Vol. XI, p. 517.
Stepp: Strahlentherapie, Vol. X, p. 143.
» Die Röntgenbeh. inn. Krankh. von Fr. Salzmann, München 1923, p. 72, 80.
Tixier: Strahlentherapie, Vol. IV, p. 300.

Thönes: D. Zschr. f. Chir., Vol. 70.
Turnure: Abstr. Fortschr. a. d. Geb. d. R-strahl. Vol. VI, p. 272.
Ullmann: Physikal. Therapie. d. Haut- u. Geschlechtskr. Stuttgart 1909.
Vassilides: Arch. d'Electr. méd. 1906.
Voelcker: Die Chir. des Halses, Handb. d. Prakt. Chir., Vol. II, Berlin 1924.
Vogt: Strahlentherapie Vol. XI, p. 956.
» Ibid. Vol. XIV, p. 836.
Weibel: Wien. kl. Woch. 1922, p. 933.
Weil, A.: Arch. d'Electr. méd. 1912, N:o 334.
Werner: Münch. med. Woch. 1913, p. 2100.
Wetterer: Handb. d. Röntgentherapie, Leipzig 1908, 1913—14, 1919—20.
» Strahlentherapie, Vol. XI, p. 360.
Williams: The Roentg. Rays in Med. and Surg. New York & London 1901, 1902, 1903.
Wilms: Münch. m. Woch. 1917, Feldärztl. Beil. N:o 1, p. 29.
Winkler: Münch. m. Woch. 1905, N:o 34.

GENERAL LIGHT-BATH TREATMENT, ITS TECHNIQUE, DOSAGE AND ARMAMENTARIUM

by

Axel Reyn, Edward Collin and *C. E. Christensen*

II. THE PLANT AND EQUIPMENT FOR GENERAL LIGHT-BATH TREATMENT BY MEANS OF CARBON ARC LAMPS

by

C. E. Christensen

In a certain measure it is undoubtedly due to the results obtained at the Finsen Institute that phototherapeutic treatment by means of carbon arc light — and, more particularly, the so-called »general light-bath treatment» — has, in spite of its relative expensiveness and the considerable time it requires, become so widely adopted in connection with a number of diseases.

A great many hospitals and sanatoria, both in Denmark and elsewhere, have of late years provided themselves with the equipment necessary for giving artificial light-bath treatment; but unfortunately complaints are often heard that the results obtained are inferior to those recorded by the Finsen Institute at Copenhagen. Investigation nearly always shows the fault to be either with the manner in which the installation has been planned, or with some lack of care in keeping the equipment up to the point — especially in the manner of cleanliness; or with insufficient insight, on the part of the staff, into the technique of the treatment. In some cases a combination of all these three causes may be responsible for the unsatisfactory results.

The following suggestions as to the manner in which the instal-

lation of an artificial-light-bath plant should be done, and the accompanying directions concerning the care and upkeep of the equipment, are based on the experiences made, in these respects, at the Finsen Institute at Copenhagen. As local phototherapeutic treatment is not employed to any great extent outside of that institution, we shall deal only with the plant and armamentarium for »general light-bath treatment».

The first and foremost condition — and one applying equally, of course, to the equipment for local treatment — is that every single part and detail should have been devised, manufactured and put in place, and the whole be kept up and kept clean, in such a manner that irregularities or interruptions of the treatment owing to defective equipment need not be feared.

It is evident that the more carelessly the plans have been devised and executed, and the poorer the quality of the materials used, the more frequent will also be the breaks and the instances of uneven running, during which the whole machinery will cease to function, either partially or altogether. But even with a plant originally perfect such troubles may occur if it is neglected to keep every part of it scrupulously and constantly clean and in perfect order of repair; and the consequence will be, in either case, inferior results of the treatment or — at any rate — retardation of the cure.

Inasmuch as the whole electric plant, and especially the lamps, must needs be charged very strongly in order to produce a sufficient amount of light of the proper quality, it is necessary, not only that the lamps, resistances, etc. should be made very solidly and from absolutely first class material, but also that the transformer and the wires should be of sufficiently ample dimensions to ensure that no risk is incurred of the treatment having to be interrupted owing to melting of the fuses, and that the light, if it should nevertheless begin to fluctuate, will become steady again at once and, as far as possible, through the action of the automatic regulator-mechanism of the lamps alone.

For the same reason it is also advisable to connect the lamps in parallel on the circuit or the transformer, wherever possible. If, namely, they are connected in series — which may, however, be considered as permissible in certain cases, on economical grounds — any disturbance of the light, in one of the lamps only, will immediately affect the performance of the others in the same series, and it will take longer time before they all become steady again. With lamps of more than 20 ampères connection in series is extremely difficult to effect, anyhow, and should not be used for purposes of light-bath treatment.

We shall now describe the various details of the installation of the apparatus for giving general light-bath treatment with carbon-arc light, beginning with that first essential factor in the installation of any plant for the exploitation of electric power:

The Supply of Electrical Energy

In cities, and in hospitals having their own generating plants, we usually find a direct-current system of supply, while in the country, where the electric energy has to be transmitted over long distances, it is largely the alternating-current system that prevails.

For therapeutical purposes, however, the carbon-arc lamps can only be used with direct currents, as will be plainly seen from the following:

In direct-current lamps the carbons connected with the two poles are of different dimensions; the positive, or upper, carbon being considerably thicker than the lower, or negative, one. During the burning of the lamp a rather deep crater forms at the end of the positive carbon, and it is from this crater that comes a very large proportion of the most effective rays; and the light is directed constantly downwards and outwards in the form of a cone having the tip of the upper carbon for its apex (see Fig. 2 p. 297).

In alternating-current lamps, where the current is continually reversing in direction, so that each carbon is by turns positive and negative, the carbon points must be equal in diameter. There is no crater formed in the upper carbon; on the contrary, both tips become pointed, and the light is emitted in all directions, only a minor portion of it striking the patient directly. For an equal amount of energy the luminous efficiency of these lamps is essentially less than that of the direct-current lamps.

In places where only alternating-current power is available it is therefore necessary to have this transformed to direct current.

But also in places where direct-current power is available — generally at 110 or 220 volts — it pays, as a rule, to reduce this pressure, by means of a transformer, to the lesser magnitude of 70 volts, which is the most suitable one for plants of this kind. While, namely, the modern type of transformer has an efficiency which, at full load may be put at about 70 per cent for the smaller ones and about 85 per cent for the larger ones, equalling a voltage drop of, respectively, 30 and 15 per cent, the loss of energy resulting from having the lamps connected directly on to the circuit will in most cases be far greater, because all that portion of the energy which

is not actually used by the lamps will be absorbed by the resistances.

A transformer is always preferable to direct connection to the circuit because by means of a transformer it becomes possible to produce the exact pressure — of 70 volts — which gives the steadiest light.

Only in one case can connection of the lamps to the circuit simply with insertion of a rheostat be recommended; namely, in places where a direct-current supply of 220 volts is available and the plant comprises only 20-ampère lamps. Under those conditions the economy of such an arrangement would be approximately the same as by using a transformer between the circuit and the lamps, but on the other hand it requires that the latter should be run in series, and this, as we have already seen, is a rather considerable drawback.

The Transformer

For the special purpose here to be kept in view the transformer should be a rotary one, and should consist of an electric motor — of alternate or direct-current type, according to circumstances — and a direct-current dynamo — preferably compound — giving, with a pressure of 70 volts, a current somewhat — say, 20 à 30 per cent — in excess of the aggregate amperage of the lamps to be served. It is not advisable to use mono-phase transformers, because the current delivered by these will often be too unsteady, owing to the fact that any fluctuations in the primary pressure pass straight through the transformer.

Manufacturers offer various types of the so-called »mercury-rectifiers» for transforming an alternate into a continuous current, but none of these apparatus exists as yet in a construction sufficiently finely regulating to make it of use in a lighting scheme for the phototherapeutical purposes here to be considered.

Switchboard Panels and Distribution Boards

In connection with the transformer there should generally be installed a switchboard panel consisting of two sections, one for each part of the transformer set.

The motor panel carries, on the front: an ammeter, a knife switch, cut-outs with their plugs, and a voltmeter. The latter is optional, but should rather be had. On the back is the starter for the motor, its shaft going through the panel and terminating in a hand-wheel at the front.

The dynamo panel carries, on the front: an ammeter, a voltmeter, knife switch, and the cut-outs with plugs. On the back is the regulating resistance, its shaft passing trough the panel to a hand-wheel in front. All connections are mounted on the back of the panel.

If the plant is a very small one comprising, for instance, only 3 lamps of 20 ampères, this whole switchboard-arrangement can be omitted. The starter for the motor and the regulating resistance for the dynamo are then mounted on, or below, the distribution board for the lamps, and the control of voltage, etc. is kept by means of the measuring instruments there.

In order to avoid interruptions and repairs it is necessary that all connections should be built in such a manner that when screwed down securely they will form a contact sufficiently solid and permanent to preclude all possibility of any metal part melting. All the apparatus, too, should be of first class make. Wherever the lamps, for instance, are not fitted with good, serviceable clutches, the wires must be provided with solid cable-shoes of some good, conducting material, brass or copper.

After leaving the transformer, the leads are run to a main *distribution board* fitted with switches and fuses for the wires to the different groups of lamps (in the manner demanded by the regulations of the Electricity Works); and still farther on — as close to the lamps as possible — are inserted one or more *service boards*, generally one for each group of lamps. Where only two groups of, for instance, three 20-ampère lamps are installed in one room, one service board will do for all six lamps, however.

A service board for three 20-ampère lamps carries, on the front: a voltmeter, an ammeter, a four-circuit switch for the voltmeter, a three-circuit switch for the ammeter, two knife-switches, and plug cut-outs for each of the lamps. Rheostats are mounted on the back of the board.

The measuring instruments — ammeters and voltmeters — both for the distribution boards and for the service boards must be of absolute precision. It is only by measuring the current and the resistance that it is possible, during the treatment, to ascertain whether — everything else being in order — the lamps are giving the proper light; therefore it does not pay to use cheap and less reliable instruments.

The knife-switches must be very solid. The ordinary ones found in the market, with indicated current capacity for the various sizes of lamps, are as a rule too feeble, and will last only a very short time; more robust types should, therefore, be used.

The amperage of the fuses, in order to avoid melting, should be considerably higher than that of the lamps. As a general rule it may be said that for 20-ampère lamps the fuses should be of the 40 ampère size, at least; and for 75-ampère lamps not less than the 125 ampère size.

Resistances

The capacity of the rheostats must be equal, on the one hand, to the ampères of current used by the lamps while burning, and, on the other hand, to the difference between the voltage given out by the circuit, resp. the transformer, and the voltage taken up by the lamps. Inasmuch as the latter should, normally, be of 55 volts, while the transformer gives out 70, the rheostat, including the leads, must consequently be capable of absorbing 15 volts.

In the exceptional cases, referred to above, in which three 20-ampère lamps are run in series on a circuit giving 220 volts of continuous current, the number of arc volts will be $3 \times 55 = 165$; and the rheostat, including the leads, must consequently, with an installation of this kind, be equal to an absorption of 55 volts.

Rheostats for 75-ampère lamps should always be adjustable, in order that the amperage may, during the striking of the arc, be reduced by interposing the full resistance. This is calculated in such a way that after the process of lighting is finished — that is, when the lamps are burning normally — the amperage may be reduced step by step over, for instance, seven contacts, from 75 to 65 or 60 ampères.

For 20-ampère lamps the rheostats need not, as a rule, be adjustable. The only case in which it is rather advisable to have them so is when the lamps are, without interposition of any transformer, connected to a circuit in which the pressure is subject to more or less considerable, periodical variations.

Leads

From the service board two wires are carried to each lamp. The minimum cross-section area, of these wires, should be: for 75-ampère lamps, 50 mm.^{2}; for 20-ampère lamps, 16 mm.^{2}.

It is true that the Danish official Rules for Electrical Wiring allow the charging of a 16 mm.^{2} wire with 75 ampères, and that, by those same rules, no greater cross-section area than 2,5 mm.^{2} is required for a charge of 20 ampères; but for wires of these dimen-

sions fuses are not allowed of higher capacity than 60 and 15 ampères, respectively, while the steady, undisturbed burning of these lamps, as well as the requisite pressure of current at the moment of lighting, demands that the fuses should have a capacity of 125 and 40 ampères, respectively. It therefore becomes necessary to calculate the required wire dimensions accordingly, and to find the cross-section areas corresponding with the latter figures. According to standard rules the proper dimensions are 50 mm.^{2} and 16 mm.^{2}, respectively.

The Lamps

It is probably in the choice of lamps that the physician or hospital board, unfamiliar with this therapy is likely to make the most serious mistakes. Arc lamps are manufactured in a great variety of dimensions and types; and by the technically ignorant it may well be imagined, or believed if so represented, that one pattern of arc lamp is just as good as another, and that any factory-made lamp can be used for the purposes of light-bath treatment.

Nothing could be more absolutely wrong, however. These lamps, being designed chiefly for street-illumination or for the lighting of large interiors, do not fulfill the conditions which must necessarily be required of a lamp that is to be used for the special work here referred to; namely, in the first place, a solidity of construction which will enable it to stand the strong currents which it is made to take; and, in the second place, a mechanism so finely regulated and so immediately responsive that the light will at no time die down or become extinguished while the treatment is going on.

The ordinary factory-made arc lamps, whose various parts are made by machine and turned out in great quantities, can, of course, be sold very cheaply; and at the Finsen Institute various experiments have been made with the object of ascertaining whether it would not be possible, by means of minor alterations, to make them serve for light-bath treatment. The results have been absolutely unsatisfactory, however; and, as already stated, they must be considered as quite unsuitable for the purpose. Since then, we use only lamps that are made expressly for light-bath treatment and in the manufacture of which, as will be seen from the following, every effort has been bent toward obtaining at once the proper amount of illumination and the right quantity of light, combined with the steadiest possible burning of the lamps.

For general light-bath treatment we employ, at the Finsen Institute, only two types; but the same amounts and qualities of light

as produced by these can, of course, be obtained also from lamps made for other amperages. It is obvious, however, that some sort of standarisation, such as adopted by us, is the only possible means of effecting some economy in the manufacture of the lamps, at the same time as it simplifies and reduces the cost of their upkeep. Experience, furthermore, has shown that these two types fulfill all reasonable conditions and requirements of the work for which they are intended; therefore we have not found any reason to go beyond them.

The 75-ampère lamps have simple shunt-regulation and are mounted in sets of two. This allows of from six to eight persons being treated simultaneously, seated.

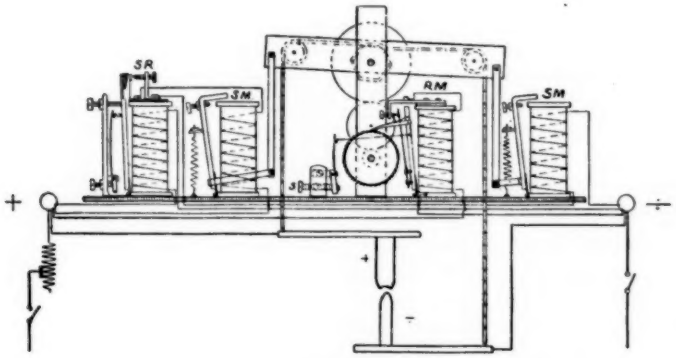

Fig. 5. Direction of current in a 75-ampère lamp. (SR, Starting Relay; SM, Starting Magnets; RM, Regulation Magnet; S, Shunt-coil Screw.)

The 20-ampère lamps have differential regulation and are mounted in sets of three. From one such set two persons lying down can be treated at the same time.

Both types of lamps work with a tension of 55 volts across the arc and are adjusted to regulate for any variation exceeding 0,25 or 0,50 arc-volt.

In their main features the two lamp types are identical. There is a base plate, on the upper side of which is the regulating mechanism; while on the under side are the carbon holders, sliding between the vertical bars of the guiding frame.

This lamp, as already stated, has simple shunt regulation; that is, the adjustment is made to constant arc-voltage only, and the coils of the regulating mechanism lie parallel to the arc.

The regulating mechanism comprises a starting device and the actual regulating, or feeding mechanism. The starting device consists of a relay, SR, which closes the circuit for the two starting magnets SM. The armature of these magnets has the form of a rocking lever, whose vertical support carries the train-gear, and in which the carbons are suspended. The carbons are »fed out» by means of a magnet RM, which by turns draws up its armature and drops it again, thereby causing a small pawl to actuate a sprocket-wheel on the hexagonal shaft of the train-gear, around which the carrying-chain of the carbon-holders is wound. When RM is working, the carbons are brought closer to one another through the respective lengthening and shortening of the two opposite chain-ends resulting from the turning of this shaft. By means of the screw S, the mechanism is adjusted to regulate the tension across the arc so as to maintain it at the voltage desired.

When the lamp is to be lighted the carbons must not touch. When the knife-switch is closed the current will therefore pass only through the starting-relay SR and the regulating coil RM, but not through the carbons.

At the moment the switch is closed SR establishes the circuit through the two starting magnets SM SM, and these attract their armature — the rocking lever — imparting to the latter a balancing movement by which the carbons are brought into contact with one another. In the same instant this happens the current passes through the carbons, and the tension on SR — the tension across the arc — drops, so that the circuit becomes momentarily interrupted. The two magnets SM SM lose their force of attraction; the rocking lever swings back and causes the carbons to separate; and thus the arc is struck. The high tension across the arc now brings RM into play and causes it to »feed out» carbon until the arc-length and -voltage for which it has been adjusted has been reached. From then on, the rôle of RM is to keep the tension across the arc constant; and it does this by gradually drawing down its armature and feeding out carbon as the latter burns away and the tension increases. This causes the arc-voltage to drop afresh, and the carbons burn away again; and thus the mechanical regulation goes on without interruption.

If, quite exceptionally, the carbons should recede so far from one another that the starting mechanism can no longer bring them closely enough together again, the regulating mechanism RM will immediately come into play and feed out carbon until the proper distance between their tips has been re-established.

If the carbons should happen to touch one another, so that a

short-circuit is established, it is not necessary to switch off the current. It is sufficient to lift the upper carbon holder a little, by means of a short wooden stick. This will immediately bring the striking and feeding mechanisms into function again and cause them to adjust the position of the carbons. It must never, in such a case, be attempted to pull the lower carbon holder downwards. The lower holder can only move as governed by the movements of the upper one; and any attempt in the direction here indicated would merely result in its becoming wrenched out of the perpendicular, or

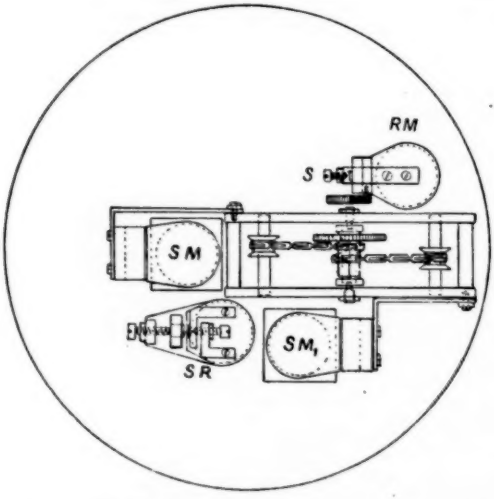

Fig. 6. — SR, Starting Relay; SM SM_1 Starting Magnets; Rm, Regulation Magnet; S, Shunt-coil Screw.

even getting stuck, between the guiding-bars, and thereby throwing the whole regulating mechanism out of function.

In order that adjustment of the feeding mechanism — by means of the screw S — may, when the lamp is lit, be made without any risk of the operator coming into contact with any loaded part of the mechanism, the screw is enclosed in a long tube which is fastened to the base-plate.

The mechanism, as already stated, is adjusted to regulate automatically for a variation in the arc-voltage of 0,25 to 0,50 volt. Sometimes, however, the spring on which the screw is acting may gradually undergo a change; getting softer, for instance, when the lamp has been burning for some time. In that case the screw

must be slightly adjusted again; but this requires no technical skill, and can best be done by the person tending the lamps.

As a general and easily remembered rule it may be said that when the ammeter shows less than 75 ampères — in which case the tension will exceed 55 volts, provided the resistance is not in

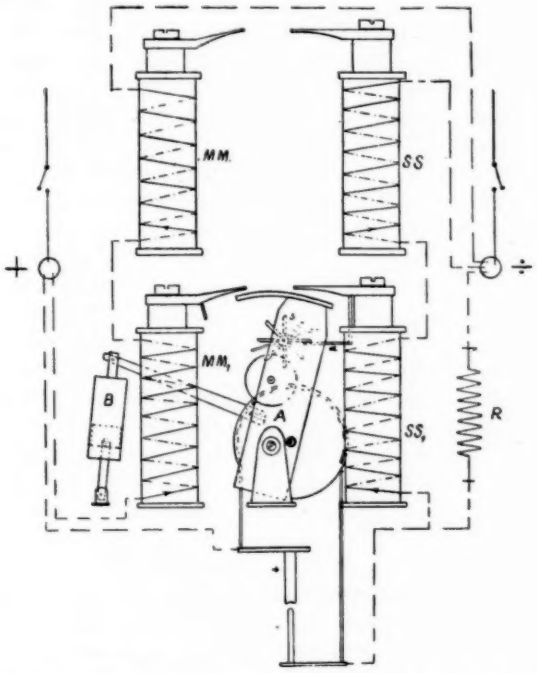

Fig. 7. — A, Train Gear; B, Air Brake; R, Rheostat: M M_1, Series Magnets; S S_1, Shunt Magnets.

— the screw should be turned to the left; in the contrary case it should be turned to the right.

The adjustment must, of course, be made by very slow degrees; the screw being turned only slightly at the time, after which the operator watches and awaits the result for some while before giving the screw another turn.

The contact-surfaces of the springs both on the starting-relay and the regulating magnet, as well as on the screws belonging to them, are platinum-plated. This plating — especially on the regulating magnet — gradually wears off, with the result that the

contact becomes less perfect. As soon as anything of this kind is noticed, the screw or the spring, or both, should be changed; and it is best, therefore, always to have a spare supply of these small accessory fittings on hand.

Fig. 6 shows the arrangement of the train-gear and various coils on the base-plate.

Fig. 7 shows the circuit in a 20-ampère lamp.

In this lamp the control of the arc is effected by a system of differential regulation; that is, both the voltage and the tension across the arc are constant.

The regulating mechanism consists of a train-gear rotating around a horizontal shaft and placed between the two sets of magnets. In this train-gear the carbons are suspended. The main current passes through the series Magnets M M_1; another current, the force of which depends directly on the tension across the arc, passes through the shunt magnets S S_1. The direction of the current in the coils is such that the two sets of magnets exert a pull on the train-gear in opposite directions, and the position of the latter at any given moment will therefore be determined by the momentary preponderance of attractive force exercised by one set or the other. As the upright of the train-gear swings back and forth the carbons simultaneously approach or recede from one another, and when its deflection from the perpendicular becomes sufficiently large in the direction of M_1 the cogwheel A is set free, and the carbons, owing to the superior weight of the upper one, are brought into contact, — carbon is »fed out».

The adjustment of the striking and feeding mechanism of these lamps is made in a manner different from that of the 75-ampère lamps, and can only be done by a skilled operator. But when once the adjustment has been properly made, no variation takes place during the use of the lamp, and it is therefore unnecessary to describe the operation here.

In this type of lamp there are no platinum-plated contact-surfaces.

As in the 75-ampère lamp, the carbons must not touch when the lamp is being lighted, and when the knife-switch is being closed the current passes only through the shunt-magnets SM SM_1.

The moment the circuit is closed, the upper part of the train-gear, which turns on the horizontal axle, becomes attracted by the shunt magnets. By this movement the ratchet-wheel is pulledfreet of the detent a, and the carbons are fed closer to one another and finally touch. Immediately this happens, current passes through M M_1, attracting the train-gear in the opposite direction; the ratchet-

wheel is once more caught by the detent; the mechanism stops, the carbons move apart, and the arc is struck.

As the arc burns and the gap is widened, the voltage between the carbons increases, while the amperage falls in the series-magnets and rises in the shunt-magnets. Therefore, as the pull of the two sets of magnets works in opposite directions, the train-gear is again attracted toward the shunt-magnets, and the carbons are brought closer together, until the gap is restored to its normal length. As the carbon burns away still further, the train-gear also is attracted more strongly by the shunt-magnets, until it is finally released, allowing the carbons to move toward one another; and thus, by the constant, automatic repetition of this back-and-forth movement of the train-gear a steady feed is maintained.

Fig. 8 shows the arrangement of the train-gear and the four coils on the base-plate of a 20-ampère lamp.

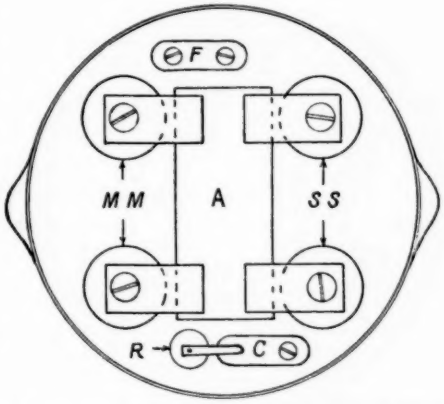

Fig. 8.. — A, Train Gear; M M_1 Series Magnets S S_1 Shunt Magnets; R, Resistance; C, Connecting Clips.

The choice of shunt-regulation for the 75-ampère lamps, instead of the generally more finely regulating differential mechanism used in the 20-ampère lamps, has been determined by considerations of the fact that in a regulating mechanism of the latter kind for a current density as high as 75 ampères the coils would be so large and costly, and would give so strong a heat, that for all these reasons they had better not be used. The large lamps have therefore been fitted with a perfected type of shunt-regulation, which controls the carbon adjustment just as finely as the differential mechanism.

Carbons

The choice of carbons for these lamps must be made with due consideration for the double requirement of, firstly, the steadiest possible burning of the lamps, and, secondly, the rather large currents that the carbons have to take.

The so-called pure, ash-free carbons give the steadiest burning, but do not support anything above a moderately strong current.

Experience has shown the »Siemens A» carbons to be the kind best suited to the purpose.

The dimensions required are,

for 75 ampères:

positive carbon . . 31×300 mm.
negative » . . . 22×300 » } cored carbons

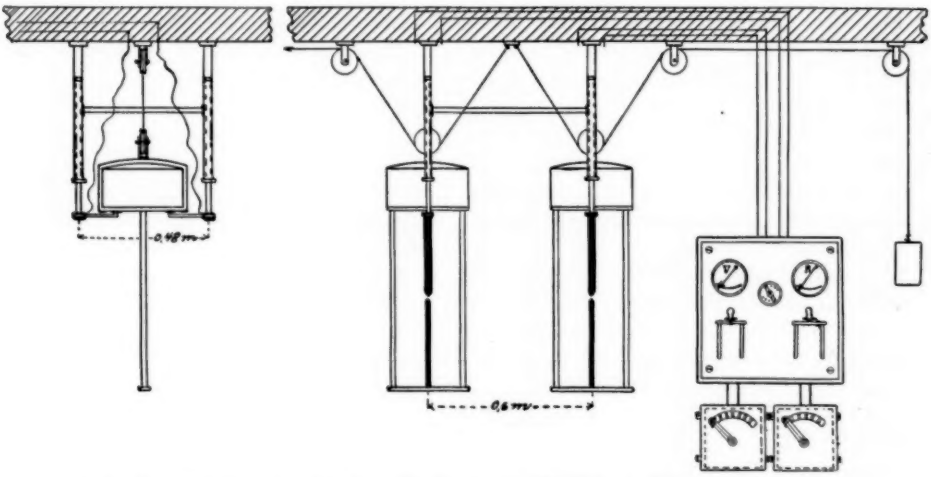

Fig. 9. — Diagram showing the arrangement of 2 75-ampère lamps mounted in parallel a) Adjustable Rheostats.

for 20 ampères:

positive carbon . . 12×300 mm. cored carbons,
negative » . . . 8×300 » solid »

It is highly important that the carbons should be perfectly dry before being placed in the lamps. They must therefore be stored in an absolutely dry place, just as great care must be taken that they do not get soiled with oil or the like.

Mounting of the Lamps

Figures 9 and 10 show the arrangement of the lamps in the bath-rooms.

The arrangements can of course, be varied to meet any particular local requirements and conditions; but any such variations must nevertheless be within the limits of the following three unconditional demands; namely,

that the lamps cannot rotate around their own longitudinal axis;

that they can be freely raised and lowered for a distance of about 1 meter; and

that the perpendicular guiding-bars of all the lamps belonging to one set lie exactly in one plan, so that no obstruction is offered,

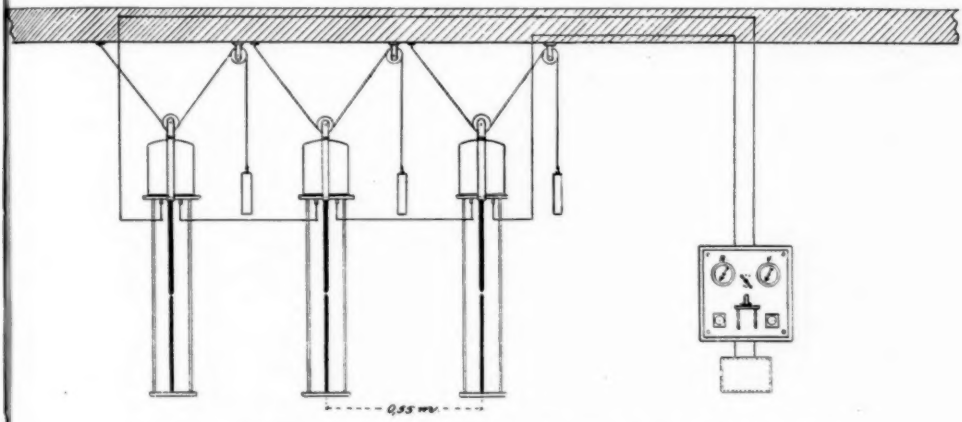

Fig. 10. — Diagram showing arrangement of 3 20-ampère lamps mounted in series. a) Rheostat.

by their shadows, to the free and full emission of light toward the patients.

Daily Supervision

The daily care and supervision of the light plant consists first of all in making sure that all connections are securely fastened, and the whole mechanism kept clean and in perfect condition. In this respect, the adjustment of the carbons in their holders presents some difficulty, which can, however, be gradually overcome by practice.

The holders must grasp the carbons so firmly that a solid and lasting contact is formed.

If the holder is screwed down too tightly the carbon will be crushed; and if it is screwed down too loosely either the screw

itself or the screw-hole will melt in such a manner that the holder can no more be tightened securely and has to be replaced by a new one. The »golden mean» is what has to be aimed at.

The carbons must be mounted in exact axial prolongation of one another. But it is not always easy to see, before the lamp is lit, whether they are precisely in the right position. If after the arc has been struck, the formation of the crater is found to be slightly excentric, it is proof that the carbons are not exactly co-axial, and they must then be brought into correct position by means of a few light taps with the wooden stick already spoken of.

The train-gear of the striking and feeding mechanisms should likewise be looked after, to make sure that they move smoothly and easily. If this is not the case, the gear must be cleaned, and this is done most effectively by blowing the dust and dirt out by means of an air-pump. *The train-gear must never be oiled*, because the heat will cause the oil to coagulate, with the result that the gear will function even more sluggishly than before.

If the back of the switch- and distribution boards, with the rheostats, are not built into some closed room in such a way as to be inaccessible to all but the persons directly concerned with their operation, a look-out must be kept every day to see that they are not made the repository for any sort of irrelevant object that might influence the current or even cause a short-circuit. Whenever any reparation has been made, care must be taken to see that all tools, stray bits of wire, etc. have been removed from the plant.

At least once a year all the lamps should be dismounted, taken completely apart, cleaned and, if necessary, repaired.

The transformer, also, must be kept scrupulously clean by wiping and blowing out the dust. It is preferable to have the transformer located in a separate room, which should, however, be situated as close to the bath-rooms as possible, so as not to have too long connections.

If sparks are observed between the commutator and the brush-carbons, something is wrong. It *may* be only a trifle, due, for instance, to a wrong position of the brushes in relation to the commutator; but it *may* also be some more serious wrong that causes the sparking. In any case, the machine must be stopped immediately, and an examination made, before any greater damage has been done.

The room in which the transformer is placed must be thoroughly dry and sufficiently ventilated.

Lighting and Extinguishing the Lamps

When the daily inspection has proved the lamps to be in proper working order, the lighting and extinguishing is done as follows:

A. Lighting:

1. See carefully to it that the carbons do not touch;
   that all the knife-switches are opened;
   that all lamp resistances (rheostats), as well as the starting resistance of the motor (»starter») and the regulating resistance (shunt-regulator) of the dynamo are pushed home (set on »0»).
2. Close the knife-switch of the motor.
3. Pull out the »starter».
4. Push over the shunt-regulator until the current of the dynamo is at 70 volts.
5. Close the knife-switch of the dynamo.
6. Close the knife-switches of the lamps.
7. When the lamps have been burning quietly for 8 or 10 minutes, cut out the resistances slowly and gradually. But if the lamps begin to get unsteady, stop cutting out the resistances at once.

B. Extinguishing:

1. Open the knife-switches of the lamps.
2. Set in the lamp resistances (set on »0»).
3. Open the knife-switches of the dynamo and the motor.
4. Push over the shunt-regulator and the starter (set on »0»).

If only some of the lamps in the plant are to be extinguished, while others are to go on burning, the knife-switches must not be opened until the current has been reduced somewhat by means of the shunt-regulator. If this precaution is neglected, the fuses will melt.

Furniture and Accessories

In every bath-room there should be a pair of tongs for handling the carbons, a spanner for fastening them in the holders, and a round wooden stick, about 80 cm. long and 2 cm. in diameter, for correcting the position of the carbons and carbon holders.

For the patients who take the treatment sitting (in groups of 6 or 8 around each set of 75-ampère lamps) there should be unpainted

hardwood chairs with slat seats (at the Finsen Institute these chairs are of beech-wood). The various parts must not be glued together, but should be assembled with brass screws, as otherwise the chairs will not stand the moisture and the continual washing. The form of the chairs should be such that the patients, while having their back irradiated, can sit astride the chair, with their arms resting on the chair-back. The chairs should be in plain, natural wood, as any paint or varnish would very soon be dissolved by the transpiration of the patients.

In every bath-room for sitting patients there should be a stretcher for use in case any patient should become ill and have either to lie down or be carried out. An ordinary »Wagner» stretcher can be used, but the best is to have a stretcher made of steel tubing, with rigid chain-bottom over which is laid a thin oilcloth matress, and with adjustable head-rest. This is the type which has for some years been used at the Finsen Institute.

In the bath-room the patient wears a shade for the protection of head and eyes against the light. These shades are made of heavy brown cartridge paper (the so-called »leather-cartridge»), and are fitted either with ear-loops of twine or with tape to tie at the back of the head. They can easily be made by the nurses, and should be renewed from time to time. To avoid any accidental promiscuity in their use they should be kept, together with the patient's towels, in a linen bag marked with his name.

There should also be, for the use of the patients, sufficiently many pairs of wooden clogs with a leather strap to slip the foot into, and a good supply of glasses to drink from, because some patients get very thirsty during their bath.

For the use of the staff and attendants there should be protecting spectacles of dark, almost entirely black glass. At the Finsen Institute two different kinds are in use; one being ordinary nickel-framed spectacles with rather large, convex glasses; and the other of the »motor-goggles» type, with a leather collar that fits tightly to the face of the wearer and prevents the light from striking his eyes from the sides. These goggles are very warm, however, and therefore rather unpleasant to wear; and on that account most of the staff prefer the first-named kind; especially as, with a little practice, they soon learn to avoid the light from the sides.

There should be a hose for slushing out the bath-room; also a flat broom or a rubber squeedge.

In the bath-rooms for lying-down patients there must be two couches for each set of lamps. These couches should be solid, but at the same time not too heavy, as they must be easy to move

about. There should be a thin oilcloth matress, but the surface of the couch must be so rigid that it does not sag under the weight of the patient in such a manner that by sinking down into the matress he is deprived of some portion of the irradiation.

At the Finsen Institute, the couch which has been adopted more and more exclusively of late consists of a frame-work, 1 m. 79 × 0,45 m., made of arc-welded steel tubing. Across this frame is stretched a rigid steel-chain matress. The four legs are connected by an X-shaped bracing-piece and are fitted with wheels. There is an adjustable head-rest, which can be raised or lowered by means of a double-screw actuated by a hand-wheel. The height of the couch is 0.88 m. The oilcloth matress is fastened on with leather loops that button over knobs along the frame of the couch.

The rest of the accessories are exactly as in the bath-rooms for the 75-ampère lamps.

The necessary gas-apparatus and sterilising vessels for bandages and instruments should, if there is no special surgical-dressing room, be locked up in some place inaccessible to the patients.

The ventilation of the light-bath room must be arranged in such a way that the carbon arcs, which are very sensitive, are not exposed to the slightest draft. At the Finsen Institute, this rather difficult problem has been solved by having the windows of the bath-rooms placed away up under the ceiling in such a manner that, when the windows are open, a steady current of cold air passes along the ceiling, gradually carrying along the warm air rising from below, while the necessary accession of fresh air is secured by having the bath-room doors fitted so as to leave a small open space between their lower edge and the floor.

So long as the lamps are lit, the heat from them is sufficient, even in winter time, to keep the room warm; but arrangements have to be made in order that it may be comfortably heated, also, some time before the patients arrive and the lamps are lighted. For this purpose, a system of central heating is best, because it makes it possible to shut off the heat when the lamps have been burning for a sufficient time.

In connection with the bath-rooms there should be shower-baths with hot and cold running water, W. C.'s with hand-wash basins and sinks, and dressing rooms with closets for the clothes of the patients (see Fig. 4 p. 300).

In general light-therapy, as in every other branch of practical medicine, it is necessary that the physician in charge of the treatment should be thoroughly familiar with all the details of its tech-

nique, and that the nurses and attendants should be carefully trained and fully familiar with the use of the lamps. The Finsen Institute will gladly undertake the training of nurses and attendants for this purpose; and the Physician in Chief, Dr. AXEL REYN, as well as Mr. CHRISTENSEN, Inspector of the Institute, are at all times ready to furnish any desired information to physicians or hospitals contemplating the introduction of general light-bath treatment.

SUMMARY

The treatise consists of two parts:

1) Technique and Dosage in general light-treatment with artificial light; and

2) Armamentarium and Equipment for general carbon-arc light baths.

In the first part, attention is called to the importance of possessing both the proper equipment and the proper technique. Then, the various sources of light are mentioned, and it is pointed out that carbon-arc light gives the best results in the general light-bath treatment of surgical tuberculosis, lupus vulgaris, and the other diseases in which photo-therapeutic treatment is applied; the authors according, however, a certain effect to the mercury light also, though considering that effect to be decidedly inferior to that of the carbon light. Some general directions are given for the dosage of light baths. The authors consider the pigmentation to play only a slight rôle as regard the cure of tuberculosis. A number of questions concerning the equipment and premises for light bath treatment are touched upon, and the authors lay stress on the importance of these premises being spacious and well ventilated. The reactions of the light are dwelt on; and the dosage in connection with the various affections is gone into in greater detail.

The second part contains a description of the various types of carbon-arc lamps used; and particular emphasis is laid on the necessity of the lamps being built with special view to their being used for carbon light bath-treatment, if all the necessary requirements of that therapy are to be fulfilled and the results obtained which are possible by that treatment.

The various machines, lamps and accessories are described in detail, with diagrams and illustrations. The importance of only first class material being used in their construction is pointed out; as well as the necessity of the plant being kept scrupulously clean and in perfect working order; and detailed directions are given in all these respects.

In the first and the second part alike, it is shown, and reasons are given, why direct currents alone can be used in an installation for carbon-light baths; just as attention is called to the importance of using carbons of the right quality and dimensions in order to obtain a powerful chemical light.

ZUSAMMENFASSUNG

Die Abhandlung besteht aus zwei Teilen:

1) Technik und Dosierung bei der allgemeinen Lichtbehandlung mit künstlichen Licht und

2) Armatur und Ausrüstung für allgemeine Kohlenbogenlichtbäder.

Im ersten Teil wird auf die Wichtigkeit einer richtigen Installation und einer richtigen Technik hingewiesen. Dann werden die verschiedenen Lichtquellen erwähnt und es wird hervorgehoben, dass Kohlenbogenlicht die besten Resultate bei der allgemeinen Lichtbadbehandlung von chirurgischer Tuberkulose, Lupus vulgaris und den anderen Krankheiten gibt, bei welchen die Phototherapie zur Anwendung kommt. Die Verff. gestehen der Quecksilberlampe allerdings auch eine gewisse Wirkung zu, halten ihren Effekt aber für entschieden geringer als den des Kohlenbogenlichtes. Es folgen dann einige allgemeine Direktiven für die Dosierung der Lichtbäder. Die Pigmentation ist nach Ansicht der Verff., was die Heilung der Tuberkulose betrifft, kaum von Belang. Bei Erörterung einer Reihe von Fragen hinsichtlich der Installation und der Räumlichkeiten für die Lichtbäder wird die Wichtigkeit von geräumigen und gut gelüfteten Behandlungslokalen betont. Es is ferner von ev. unerwünschten Reaktionen auf die Lichtwirkung die Rede und die Dosierung wird mit Hinsicht auf die verschiedenen Affektionen ins Einzelne besprochen.

Der zweite Teil des Artikels enthält eine Beschreibung der verschiedenen Typen der verwendeten Kohlenbogenlampen; besonderes Gewicht wird auf die Notwendigkeit gelegt, dass diese Lampen mit besonderer Berücksichtigung ihrer Bestimmung zu Kohlenlichtbädern konstruiert seien, wenn allen notwendigen Erfordernissen dieser Therapie genügt sein soll und man die Resultate erhalten will, die bei dieser Behandlung möglich sind.

Die verschiedene Maschinen, Lampen und zugehörigen Teile sind im Detail beschrieben, mit Diagrammen und Illustrationen veranschaulicht. Dabei wird hervorgehoben wie wichtig es ist, dass bei ihrer Konstruktion nur erstklassiges Material gebraucht wird; sowie dass die Anlage peinlich rein und in vollkommener Funktionstauglichkeit gehalten wird; in allen diesen Beziehungen sind detaillierte Direktiven gegeben.

Im ersten wie im zweiten Teil wird gezeigt und begründet, warum nur direkter Strom zur Installation von Kohlenbogenlichtbädern verwendet werden kann; ebenso wie auf die Wichtigkeit der Verwendung von Kohlenstiften der richtigen Qualität und Dimension hingewiesen wird, um ein chemisch wirkungskräftiges Licht zu erhalten.

RÉSUMÉ

Ce travail se divise en deux parties:

1) Technique et dosage dans le traitement par les bains généraux de lumière, avec lumière artificielle et

2) Instrumentation et installations pour les bains généraux de lumière à l'arc de charbon.

Dans la première partie, les auteurs attirent l'attention sur l'importance d'une instrumentation et d'une technique appropriées. Ils énumèrent ensuite les différentes sources lumineuses et concluent que l'arc de charbon est celle qui donne les meilleurs résultats dans le traitement, par les bains de lumière généraux, de la tuberculose chirurgicale, du lupus vulgaris et des autres affections justiciables de la photothérapie; tout en accordant une certaine action à la lampe à mercure, les auteurs considèrent cette dernière source lumineuse comme inférieure à l'arc de charbon. Ils donnent en outre quelques di-

rectives pour le dosage des bains de lumière. Ils estiment que la pigmentation ne joue qu'un rôle secondaire dans la cure de la tuberculose. Ils étudient diverses questions concernant l'installation et les locaux nécessaires pour le traitement photothérapique et insistent sur la nécessité de disposer de locaux spacieux et bien aérés. Ils s'étendent sur les réactions à la lumière et spécifient d'une façon détaillée les doses applicables aux diverses affections.

La seconde partie contient une description des diverses lampes à arc actuellement en usage; ils insistent sur la nécessité d'avoir une lampe spécialement construite en vue du traitement par les bains de lumière à l'arc de charbon, si l'on veut satisfaire à toutes les conditions nécessitées par ce mode de traitement et si l'on veut en obtenir les meilleurs résultats possibles.

On donne une description des divers appareils, lampes ou accessoires, avec diagrammes et illustrations. Les auteurs insistent sur l'importance qu'il y a à disposer d'un matériel de première qualité dans la constructions de ces appareils et sur la nécessité de tenir l'instrumentation dans un parfait état de propreté et dans un parfait ordre de fonctionnement; des directives détaillées sont données à cet égard.

Dans la première et la seconde partie, les auteurs signalent, avec preuves à l'appui, la nécessité de faire exclusivement usage des courant continus dans les installations de bains à la lumière de l'arc à charbon; enfin ils attirent l'attention sur la nécessité, afin d'obtenir une lumière d'une activité chimique intense, de ne se servir que de charbons de qualité et de dimensions appropriées.

List of some Danish works dealing with the subject of general light-treatment. For foreign works on this subject see BERNHARDT: Sonnenbehandlung in der Chirurgie (Enke, Stuttgart) and ROLLIER: die Heliotherapi der Tuberkulose (Julius Springer, Berlin).

BEGTRUP HANSEN: Om Lysbehandling af Tuberkulose (Beretning fra Nationalforeningen till Tuberkulosens Bekæmpelse 1916).

BLEGVAD: Traitement de la tuberculose du larynx par bains de lumière généraux a lampe à arc (Finsen), (Revue de Laryngologie et d'Otolog. 1923).

E. COLLIN: A Study of the Roentgen Aspect at Tuberculosis of the Joints and its Relation to the clinical Aspect, especially when under Treatment by Universal Light Baths. Acta Radiologica Vol. I.

N. P. ERNST: Results of treatment of Surgical Tuberculosis with Carbon Arc Light Baths. Acta Radiolog. Vol. I.

K. A. HASSELBALCH: Die Wirkungen des chemischen Lichtbades auf Respiration und Blutdruck (Skand. Archiv. f. Physiologie 1905) Det kemiske Lysbads Anvendelse ved indre Sygdomme (Hospitalstid. 1906).

K. A. HASSELBALCH und JACOBÆUS: Über die Behandlung von Angina pectoris mit starken Kohlenbogenlichtbäder (Berl. klin. Wochens. 1907).

K. A. HEIBERG: Nogle Bemærkninger om fortsatte Kulbuelysbades Virkning paa Huden (og Anvendelse i Therapien) Bibliothek for Læger 1921).

ROLF HERTZ: De almindelige Principper for Behandling af Tuberculose i Led og Knogler med særligt Hensyn til Organisationen deraf i Praxis (Ugeskrift for Læger 1921) De konservative Behandlingsmaader af kirurgisk Tuberkulose (Ugeskrift for Læger 1918).

K. K. K. LUNDSGAARD: Das universelle Lichtbad in der Ophtalmologie (Klinische Monatsblätter für Augenheilkunde 1921).

OLDENBURG: Lysbehandling af Tuberculose (Ugeskrift for Læger 1917).

AXEL REYN: Om behandling af kirurgisk Tuberkulose med Højsolsbade (Forsøg paa at erstatte Solbadet med kemiske Kulbuelysbade. (Nordisk Tidskrift for Therapi 1914). Light and Roentgen-Treatment of Tuberculous Lymphomata (Acta Radiologica Vol. III). Light Treatment in Medicine (Radiology Vol 10. The artificial Lightreatment of Lupus and other Forms of Tuberculosis (Brit. Medic. Jour. 1923).

AXEL REYN und N. P. ERNST: Über die Anwendung künstlicher Lichtbäder bei Lupus vulgaris und chirurgischer Tuberkulose (Strahlentherapie Vol. VI 1915.) Om Anvendelsen af kunstige kemiske Lysbade ved Lupus vulgaris og kirurgisk Tuberkulose (Hospitalstidende 1917; Ugeskrift for Læger 1918).

V. RUBOW: Et Grundincitament i den interne Medicins fysiske Therapi: Lyset som Stofskifteincitament (Hospitalstidende 1914).

V. RUBOW & CARL SONNE: Untersuchungen über die Wirkung der universellen Bogenlichtbehandlung auf die Respiration bei Hertzkrankheiten. (Zeitschrift f. klin. Med. Bd. 73.)

V. RUBOW & C. H. WÜRTZEN: Lichtbehandlung b. Lungentuberkulose (Strahlenth. Bd. VII).

VIGGO SCHMIDT: Om foreløbige Resultater af Lysbehandling ved Lungetuberkulose (Hospitalstidende 1915).

CARL SONNE: Sur la mode d'action de bain de lumière universel. (Compt. rend. de la Société de Biologie 1920.)

OVE STRANDBERG: Über die Anwendung des universellen Lichtbades in der Rhino-Laryngologie. (Zeitschr. f. Laryngologie Bd. VII.) Die Behandlung der chronischen Osteitis im Processus mastoid. und ostemporale mit universellen Kohlenbogenbädern (Monatsschr. f. Ohrenheilk. 1920). Bemerkungen zur tuberkulösen Mittelohrenzündung und ihren Komplikationen mit besonderer Berücksichtigung der Behandlung mit Finsenbädern (Monatsschrift für Ohrenheilkunde 1922). Über die Behandlung der Larynxtuberkulose mit Finsenbädern. (Deutsch. mediz. Wochenschr. 1922.)

CARL WITH: Studies on the effect of light on vitiligo (British Journ. of Dermatolog. Vol. 32).

WEITERE BEITRÄGE ZUR RÖNTGENOLOGIE DER ABDOMINELLEN MISCHGESCHWÜLSTE

von

Hugo Laurell

Die Bedeutung der Röntgenuntersuchung für das Diagnostizieren der Dermoidzysten und anderer Mischgeschwülste ist noch nicht gebürend beachtet worden — den wenigen kasuistischen Beiträgen der Röntgenliteratur nach zu urteilen — trotzdem einige Verfasser (LEXER u. a.) schon im Anfang des 20. Jahrhunderts darauf hingewiesen haben, dass in den Fällen, wo diese Geschwülste Zähne oder Knochenanlagen enthalten, Röntgen für die Diagnose ausschlaggebend werden kann.

In einem Aufsatz dieser Zeitschrift im Jahr 1922 wurden vom Verfasser drei Fälle von Zahn- und Knochenenthaltenden abdominellen Mischgeschwülsten erwähnt, die während der Jahre 1914—1919 im Akademischen Krankenhaus von SÖDERLUND und dem Verfasser untersucht worden waren, wo Röntgen in zwei Fällen für die Diagnose ausschlaggebend gewesen war. Seitdem sind in demselben Krankenhaus noch zwei ähnliche Fälle zur Röntgenuntersuchung gekommen. In dem einen Fall war die Diagnose schon vor der Röntgenuntersuchung klargestellt, und diese hatte nur zur Aufgabe, vor der Operation die Struktur und die topographischen Verhältnisse der Geschwulst klarzulegen. In dem anderen Fall wurde als ein Nebenbefund bei einer Skelettuntersuchung eine Mischgeschwulst im kleinen Becken durch den Fund eines Kieferfragments mit einer Anzahl darin steckender Zähne nachgewiesen. Diese zwei Fälle, die mit Röntgen zu untersuchen ich Gelegenheit gehabt habe, werde ich unten in Kürze erwähnen. Für die Überlassung des Journalmaterials möchte ich hier dem Vorstand der chirurgischen Abteilung des Akademischen Krankenhauses, Prof. G. NYSTRÖM, meinen besten Dank aussprechen. Die mir zugängliche Röntgenliteratur bis zum Jahre 1922 betreffs dieses Themas ist in dem obenerwähnten Aufsatz in

dieser Zeitschrift vorgelegt worden, worauf hier hingewiesen wird. Seitdem sind in der Literatur noch einzelne Beiträge zur Röntgenologie der Dermoidzysten erschienen. So habe ich Aufsätze von ALEXANDER, PLESS und AIME gefunden. Die Fälle dieser drei Verfasser werden unten in Kürze referiert. Zuerst aber möchte ich das Literaturverzeichnis bis z. J. 1922 mit einer kurzen Mitteilung von GOSSET (1913) und mit einem Aufsatz von C. H. FAGGE in Brit. J. Surg. i. J. 1919 mit dem Titel »Bilateral ovarian dermoid-cysts simulating renal colic» vervollständigen. FAGGE konnte bei der Röntgenuntersuchung zwei Zähne nachweisen und dadurch die Diagnose klarstellen. Die Wurzelkanäle traten deutlich hervor. In keiner der beiden Zysten fanden sich andere Zahn- oder Knochenanlagen als diese zwei Zähne; einige partiell verkalkte Gebiete traten aber hervor. Auch dürfte erwähnt werden, dass B. J. MC CLELLAN i. J. 1921 mit Hinweisung auf u. a. diesen Fall und auf einen eigenen, der jedoch nicht vor der Operation röntgenphotographiert worden war, die grosse Bedeutung der Röntgenuntersuchung für das Diagnostizieren dieser Geschwülste hervorhebt. GOSSET erwähnte 1913 einen Fall von Dermoidzyste mit zwei Zähnen welch letztere bei der Röntgenuntersuchung als ein dreieckiger Schatten hervortraten. Die Lage des Schattens veranlasste an einen Ureterstein zu denken.

I. J. 1924 beschreibt ALEXANDER unter dem Titel »Die Vortäuschung eines Uretersteins durch den Zahn eines Ovarialdermoids» einen klinisch und röntgenologisch sorgfältig untersuchten Fall eines Dermoids. Bei der Röntgenuntersuchung wurde im kleinen Becken ein seiner Natur nach unbestimmbarer Konkrementschatten beobachtet, der, wie es sich später herausstellte, einem Zahn in der Dermoidgeschwulst entsprach. Infolge seiner Lage und der klinischen Symptome hegte man den Verdacht, dass es ein Ureterstein wäre, und um die eventuelle Verbindung mit einem der Harnleiter festzustellen, wurde der Konkrementschatten nach Einlegen eines schattenbildenden Ureterkatheters photographiert. Bei der ersten Röntgenaufnahme deckte sich der Schatten mit dem des Ureterkatheters, erschien aber nach der Belichtung aus einer anderen Richtung auf der Platte 1 Cm. ausserhalb des Katheters und wurde deshalb vom Röntgenologen als ein Pseudoureterstein aufgefasst. Der Ureter wurde jedoch probatorisch freigelegt, ein Stein aber wurde nicht gefunden; von demselben Schnitt aus wurde später die palpable Geschwulst aufgesucht, und zeigte sich als das obenerwähnte zahnenthaltende Dermoid. Keine genaue Beschreibung des Zahnes wird gegeben. Der Zahn scheint jedoch nicht so gut entwickelt oder auf der Platte so deutlich gezeichnet gewesen zu sein, dass er als ein Zahn hätte identifiziert werden können.

Pless beschreibt ein Ovarialteratom, das vor der Operation durch eine kombinierte klinische und röntgenologische Untersuchung diagnostiziert werden konnte. Im kleinen Becken wurde ein kindesfaustgrosser harter Tumor palpiert, welcher mit dem Uterus undifferenzierbar im Zusammenhange und infolge starker zirkulärer Verwachsungen vom Kreuzbeine nicht verschiebbar war. Bei der Röntgenuntersuchung projizierte sich auf dem kaudalen Teil des Kreuzbeins ein nussgrosser intensiver Schatten, welcher von einem grösseren Schattenringe umgeben war, wie im Querschnitte eines Eies das Eidotter von der Eischale. Der aufpräparierte Tumor bestand aus einer harten kalkhaltigen Schale, in welcher sich ein nussgrosser höckeriger Knochen, von Haaren und gallertartiger gelber Flüssigkeit umgeben, befand.

Aime diagnostizierte röntgenologisch eine orangegrosse Dermoidzyste durch den Nachweis eines unregelmässig geformten, etwa nussgrossen, konkrementähnlichen Schattens, der von einer orangegrossen Schale (?) (coque ovoide) umgeben war. Die Operation erwies vor und rechts vom Uterus eine gestielte Dermoidzyste, die vom linken Ovarium ausgegangen war. Aus der Darstellung Aime's geht nicht hervor, was an dem Präparate der auf der Platte des Beckens ersichtlichen und dem Anscheine nach kalkdichten Schale entspricht. Eigentümlicherweise gibt der Verfasser an, dass »la radiographie faite après l'opération confirme l'absence de calcification de la paroi», obwohl die reproduzierten Röntgenbilder der Zyste vor und nach der Operation vielmehr die Annahme zu stützen scheinen, dass die Wände der Zyste zahlreiche kalkdichte Stellen enthalten, die in geeigneter Projektion als ein unvollständiger Ringschatten hervortreten. Das Bild der exstirpierten Zyste erscheint als ein inhomogener, marmorierter Schatten, der in hohem Grade dem Schatten ähnlich ist, welchen der oben erwähnte Pless'sche Fall von Dermoidzyste mit kalkhaltiger Schale zeigt.

In den bis jetzt publizierten Fällen von röntgenologisch diagnostizierten Dermoidzysten und Teratomen hat die Diagnose, wie aus dem Obenerwähnten hervorgeht, infolge des Vorhandenseins von Zahn- und Knochenanlagen oder von kalkdichten Einlagerungen festgestellt werden können.

Teoretisch könnte man, worauf ich früher hingewiesen habe, vermuten, dass ein Teil der Dermoidzyste, und zwar ihr oft fettreicher Inhalt, sich, wenn die Zyste gross genug geworden ist, wie ein im grossen gleichmässig abgerundeter, negativer Schatten zeichnen könnte. Die Zyste wurde sich also auf ähnliche Weise zeichnen, wie es ein grosser Kolesterinstein bisweilen tut. Event. könnte auch ein Dermoidzapfen wie eine Aussparung von der Kante des abgerundeten, negativen Schattens hervortreten. Wenn z. B. grosse Gasansammlungen im Kolon vorhanden sind, wäre eine falsche Deutung jedoch

leicht möglich. Ein positiver Untersuchungsbefund in der Gestalt eines abgerundeten negativen Schattens dürfte unter allen Umständen der Kontrolle wegen wiederholt und der Befund mit Rücksicht auf andere mögliche Fehlerquellen kritisch beurteilt werden. In dem Fall von JOSEPHSON-SÖDERLUND wurde zwar ein abgerundeter negativer Schatten auf der Platte beobachtet, der von JOSEPHSON als ein Ausdruck der Zyste gedeutet wurde. Es dürfte jedoch nicht möglich sein zu entscheiden, ob seine Deutung richtig ist, da die Untersuchung nicht darauf eingerichtet wurde, die Übereinstimmung zwischen der Zyste und dem gefundenen negativen Schatten zu beweisen. Die Sichtbarkeit eines negativen Schattens wurde auch nicht als ein Ausdruck von grossem Gehalt an Fett sondern an Blut erklärt; die Zyste war nämlich infolge der Stieldrehung abnorm stark durchblutet. Diese Deutung kann jedoch nicht von seiten der Röntgenologen acceptiert werden. ODQUIST scheint der erste zu sein, der nach einem systematischen Suchen einen negativen Dermoidschatten beobachtet hat. Bei der Tagung der schwedischen Radiologen in Stockholm im Mai im Jahr 1924 hat er Platten von einem Fall einer Dermoidzyste demonstriert, wo er die Diagnose vor der Operation gestellt hatte, indem er einen abgerundeten, schwach hervortretenden, negativen Schatten, der, wie er glaubte, dem fettreichen Inhalt der Zyste entsprach, nachwies.

Fälle von Zahn- oder Knochenführenden Geschwülsten, die seit d. J. 1914 in dem Akademischen Krankenhaus zu Uppsala untersucht worden sind

Fall 1—3 siehe Acta Radiologica 1922.

Fall 4. A. 474/1922. Frau L., 21 Jahre alt. *Cysta dermoides ovarii.* Hat am 5. XII. 1921 eine schwere Niederkunft überstanden. Gleich nach der Niederkunft starke Druckempfindlichkeit am ganzen Bauch. Am folgenden Tage traten, so bald die Patientin sich drehte heftige Schmerzen im rechten unteren Teil des Bauches auf. Allmählich hat sich eine grosse fluktuierende Resistenz entwickelt, die die rechte Seite des Bauches ausfüllte und vom Uterus bis an den Rippenrand reichte. Am 15. XII wurde ein Einschnitt in den hinteren Fornix gemacht (JOSEPHSON), und dabei wurde eine grosse Menge übelriechenden Eiters entleert. Der Harn enthielt weder Bakterien noch Eiter, aber hyaline und körnige Zylinder. Die Resistenz im Bauch nahm während der folgenden Tage trotz reichlichen Flusses per vaginum nicht ab. Deshalb wurde ein neuer Einschnitt am 19. XII gemacht. Wechselschnitt für lateral liegende Appendizitis. Beim Öffnen des Peritoneum strömte unter Druck stehender, stinkender Eiter heraus. Der Appendix wurde nicht im Abszess angetroffen. Die Temperatur war nach der Operation hoch und hinten auf der rechten Lungenbasis liess sich eine Dämpfung nachweisen. Man hegte deshalb den Verdacht, dass ein subphrenischer Abszess vorhanden wäre, und eine Röntgenuntersuchung wurde verlangt.

Fig. 1. Der konkrementähnliche Knochen der Zyste erscheint oberhalb der Crista iliaca.

Fig. 2. Das Röntgenbild schematisch nach Koloneinguss und Fistelausfüllung.

Die Röntgenuntersuchung am 22. XII. zeigte, dass die rechte Zwerchfellskuppel 3.7 cm. höher als die linke stand, und dass sie sich bei ruhiger Atmung ein wenig schlechter als diese letztere bewegte, 0.5 cm. gegen gut 1 cm. auf der linken Seite. Ihr hinterer Teil bewegte sich aber auch und ein Pleuraexsudat wurde nicht beobachtet. Starke Gasblähung des Kolons.

Röntgengutachten. Die relativ gute Beweglichkeit des rechten Zwerchfells und das Fehlen von Pleuraexsudat widerspricht dem Vorhandensein einer Eiteransammlung direkt unter der Kuppel.

Die Temperatur sank bald, und die Resistenz im Bauch wurde allmählich kleiner, aber noch nach einem Monat blieb ein faustgrosser fluktuierender Tumor zurück.

Die Bauchwunde war am 28. I. 1922 geheilt, aber man fühlte noch wie zuvor oberhalb der Narbe einen fluktuierenden Tumor. Deshalb wurde am 30. I (HOLM) *ein dritter operativer*

Eingriff gemacht. Der vermutete Abszess wurde durch einen Schnitt gleich oberhalb der alten Narbe geöffnet. Es zeigte sich, dass er übelriechenden Eiter und Dermoidinhalt (Haar und Detritus) enthielt. Die Zyste wurde drainiert.

Bei einer Untersuchung am 23. II. ergab sich, dass der Uterus nach rechts hinübergezogen war, und oberhalb und ausserhalb der rechten Uterinecke fühlte man eine Ausfüllung. Die Patientin wurde mit zurückgebliebener Fistel entlassen. Diese sezernierte weiterhin übelriechenden Eiter, und deshalb kam die Patientin im Sept. 1922 zwecks Operation wieder zurück.

Fig. 3. Das Röntgenbild der exstirpierten Dermoidzyste.

4. IX. Unter den alten Narben wird in der Tiefe ein hühnereigrosser nicht schmerzhafter Tumor palpiert. Bei harter Palpation deutliche Fluktuation. Der Bauch im übrigen weich und unempfindlich.

Eine *Röntgenuntersuchung* wurde, sowohl vor als auch nach einem Koloneinguss und einer Fistelausfüllung (Fig. 1 und 2) am 8. IX. unternommen. Diese ergab als Befund, dass ein ungef. apfelgrosser Tumor vor dem Caecum lag, und, wenn der Darm angefüllt war, eine Impression dessen vorderer Fläche verursachte. In dem Tumor befindet sich eine unregelmässig gebildete Knochenanlage, die sich oberhalb der Crista iliaca zeichnet und die, wenn man von einigen schwach gezeichneten Knochenausläufern der wurzelähnlichen Ausschüsse absieht (Fig. 1), der Form nach an einen Molar erinnert. Von einem wirklichen Zahn scheint nicht die Rede zu sein. Das Knochenstück buchtet gegen einen Hohlraum vor, der zum Teil von der Kontrastmasse, die für die Fistelausfüllung gebraucht wurde, ausgefüllt worden ist.

Operation am 11. IX. (G. Nyström). Es zeigte sich, dass die Zyste von dem rechten Ovarium ausging. Sie war von den Gedärmen ganz frei, aber adhärent lateral vom Caecum und gegen die vordere Bauchwand ringsum den Fistelgang. Die Zyste wurde nebst dem Ovarium und dem zunächst liegenden Teil des rechten Eileiters exstirpiert.

Die Patientin wurde am 29. IX. als gesund entlassen.

Bei *Röntgenuntersuchung* der exstirpierten und von Kontrastmasse reingespülten Zyste zeigte sich deutlich die Form der Knochenmasse (Fig. 3). Die Figur ist in natürlicher Grösse reproduziert worden. Dichte, spongiöse Struktur ist, wenn man ein Vergrösserungsglas benutzt, an mehreren Stellen auf dem Originalfilm zu sehen. Einige kleine Reste des Kontrastmittels sieht man in der Nähe der Knochenanlage.

Das Präparat. Die Zystenwand ist etwa $^1/_2$ Centimeter dick; die Knochenmasse befindet sich in einer Verdickung der Wand, die sich wie ein etwa daumenendegrosser Zapfen circa 1 Cm. gegen das Lumen der Zyste hervorbuchtet. In der Zyste befinden sich zahlreiche teils lose teils festsitzende Haare von einer Länge bis zu 3.5 Cm. Mikroskopische Untersuchung ist nicht vorgenommen worden.

Epikrise. Eine junge Frau erkrankt in Verbindung mit einer Niederkunft an einer akuten Bauchaffection. Ein rechtseitiger, grosser, intraperitonealer Abszess entwickelt sich sehr schnell und macht wiederholte chirurgische Eingriffe nötig. Der Fall wird anfangs als eine gangraenöse Appendizitis aufgefasst, aber der Appendix wird nicht in dem Abszess angetroffen. Erst bei dem dritten Eingriff, der die Zyste selbst trifft, wird die Art der Affektion durch die Entleerung eiterhaltigen aber im übrigen ganz typischen Dermoidinhalts klargelegt. Früher, bei Schnitt in den Fornix und bei Wechselschnitt für Appendizitis, war nur übelriechender Eiter abgegangen. Offenbar war die Dermoidzyste infiziert worden und hatte zu einer Eiterbildung in der Umgebung, die bei den ersten Operationen entleert wurde, Anlass gegeben. Vor einer letzten radikalen Operation wurde eine Röntgenuntersuchung vorgenommen; dies geschah etwa $^3/_4$ Jahr nach dem ersten Eingriff. Röntgen zeigte, dass die Zyste vor dem Caecum lag und eine Knochenanlage in ihrer Wand hatte. Wenn eine Röntgenuntersuchung früher gemacht worden wäre, hätte die Art der Krankheit ohne Zweifel früher klargelegt werden können, da die deutliche und unregelmässige Knochenanlage notwendig den Gedanken an eine Mischgeschwulst erweckt hätte. Vielleicht hätte jedoch auch ein Korallenstein differenzialdiagnostisch in Betracht gezogen werden müssen, der in diesem Falle, entweder in einer gesenkten oder erweiterten Niere gelegen hätte, oder nach Perforation einer pyonephrotischen Niere seine gesenkte Lage dicht oberhalb der Crista iliaca eingenommen hätte. Die intra- oder retroperitoneale Eiterbildung könnte auch so ihre Erklärung finden. Die relativ grosse Beweglichkeit der rechten Zwerchfellkuppel, auch ihrer hinteren Teile, ebenso wie der Mangel an Pleuraexsudat, widersprachen aber gewissermassen einem grossen paranephritischen Abszess auf Steinbasis. Gegen eine infizierte Steinniere sprachen auch in noch höherem Grade die klinischen Funde und die Anamnese.

Die Operation zeigte, dass sich die Dermoidzyste von dem rechten Eierstock aus entwickelt hatte. Die hohe und fixierte Lage der Zyste ist diagnostisch interessant, und hat hier dazu beigetragen, die Diagnose zu erschweren. Aus der Literatur sind zwar nicht wenige Fälle von Oberhalb des kleinen Beckens liegenden Dermoidzysten bekannt, teils ohne teils mit Verbindung mit den Adnexa durch einen Bindegewebsstrang oder Stiel von wechselnder Länge und Dicke; in der Regel liegen jedoch die Dermoidzysten in dem kleinen Becken. In dem obenerwähnten Falle kann die fixierte hohe Lage der relativ kleinen Dermoidzyste in der rechten Regio hypogastrica eine natürliche Erklärung durch die durchgemachten Gravidität finden sowie durch eine im Zusammenhang mit der Niederkunft stehende Infek-

tion der Zyste und ihrer Umgebung mit Verlötung und sekundären Verwachsungen in dieser Gegend, ehe der Uterus involviert wurde.

Wenn der Uterus in diesem und ähnlichen Fällen nach der Gravidität an Grösse abnimmt, und die Adnexa wieder streben, ihren natürlichen Platz in dem kleinen Becken einzunehmen, wird somit die cephal-lateral dislozierte und durch die Entzündung fixierte Zyste einem Ziehen durch die Adnexa gegen das kleine Becken herunter ausgesetzt. Es wäre unter solchen Umständen kein Wunder, wenn der ovarielle Stiel der Zyste, besonders wenn er schmal ist, sich immer mehr verdünnt und verlängert und allmählich sogar atrophiert und verschwindet. In einer derartigen Mechanik dürfte man sich also bisweilen eine Ursache der Lösung der Ovarialzysten von den Adnexa denken, welche Lösung nicht selten beobachtet wird. Als einen Ausdruck einer vorhandenen Straffung, in diesem Falle zwischen dem Uterus und der fixierten Zyste, kann man die hier vorliegende Dislokation des Uterus nach rechts ansehen. Eine Ablösung der Dermoidzyste hatte sich aber in diesem Falle nicht entwickelt. Dass Adnextumoren in der oben skizzierten Weise disloziert und an verschiedenen Stellen im Bauche fixiert werden, ist seit lange bekannt (Freund). Dass die Dermoidzysten auch oft die Tendenz haben, sich von ihrem Stiel loszumachen, nachdem sie fixiert und so z. s. an eine andere Stelle im Bauche umgepflanzt worden sind, wird oft behauptet (siehe z. B. Lexer). Die Ursache ist in verschiedenen Momenten vielleicht vor allem in der Stieldrehung zu suchen. Eine solche Umpflanzung dürfte jedoch seltener von so schweren inflammatorischen Komplikationen wie hier begleitet sein, obschon es nach Freund eine allbekannte Tatsache ist, dass Ovarialdermoide oft und besonders häufig im Wochenbett zu Entzündungen Veranlassung geben. Die Zirkulationsstörungen, die bei der Stieldrehung gestielter Dermoidzysten leicht entstehen, können natürlich teils zu einem Peritonealreiz und Verwachsungen Anlass geben, teils auch zur Abtorquierung der Zyste beitragen. Was auch die Ursache der sekundären Verwachsungen in dem speziellen Falle sein mag, sicher ist, dass die Neigung der Dermoidzysten zu verbreiteten und festen Verwachsungen in der Literatur oft erwähnt worden ist (Hofmeier u. a.).

Fall 5. Chir. Abt. 791/1925. Ruth O., 31 Jahre alt; Frau. *Cysta dermoides oder teratoma ovarii.* Hat zwei Partus durchgemacht. Die Menstruation ist immer normal gewesen. Wurde im Dezember 1923 wegen Cancer mammae sin. operiert. Im November 1924 bekam sie nach Verheben »Hexenschuss», hat sich seitdem im Rücken steif gefühlt und da Schmerzen gehabt; ebenso hat sie ein Gürtelgefühl ringsum dem untersten Teil des Brustkastens gehabt. Lokale Metastasen sind nicht palpabel.

Röntgenuntersuchung am 30. III. zeigte Destruktion und Kompression von ein paar Dorsalwirbeln, wahrscheinlich auf Tumorbasis, ausserdem als Nebenbefund ein Dermoid oder Teratom im kleinen Becken. Oberhalb des unteren Teils des sacrums zeichnet sich auf der rechten Seite des Beckens eine Gruppe dicht liegender aber leicht erkennbarer Zähne (Fig. 4). Ein Eckzahn, ein Molar und zwei Zähne, die an Vorderzähne erinnern, können unter ihnen unterschieden werden. Nur die Krone und der Hals des Eckzahns und nur die Krone des Molars sind entwickelt. Noch eine Zahnkrone ist sichtbar; ihre Art ist aber röntgenologisch unbestimmbar. Die Zähne, wenigstens fünf an der Zahl, sitzen in einer wenig dichten Knochenmatrix von geringer Ausdehnung. Die zierliche, papierdünne Verdichtungszone, die die Zahnfächer der in Entwicklung stehenden Zähne begrenzt, tritt ringsum die Molaren auf einigen der Originalfilme deutlich hervor. Bei den entwickelteren Zähnen sieht man auch deutlich die Zahnhöhle und den Wurzelkanal. Neben dem Tumor werden ein paar rundliche Gasansammlungen in dem Colon projiziert, aber irgend einen von fetthaltigem Dermoidinhalt herrührenden negativen Schatten hat man nicht bemerken können, auch nicht bei stereoskopischer Untersuchung. Die Patientin hat niemals Beschwerden vom Bauch her gehabt, die mit der röntgenologisch erwiesenen Mischgeschwulst in Verbindung gesetzt werden könnten. Eine Operation konnte deshalb, besonders mit Rücksicht auf das Hauptleiden der Patientin, nicht in Frage kommen. Damit die Diagnose jedoch möglichst gut bestärkt würde, wurde die Patientin nach der gynäkologischen Abteilung geschickt, um dort untersucht zu werden. Dozent NAESLUND konnte konstatieren, dass sich an der Stelle der rechten Adnexa eine hühnereigrosse, unempfindliche und bewegliche Geschwulst befand, und dass die linken Adnexa ohne Befund waren. Der Uterus war klein und anteflektiert.

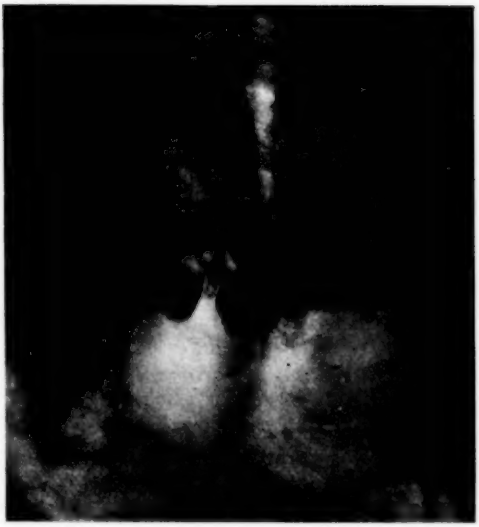

Fig. 4.

Epikrise. In diesem Falle wurde also zufälligerweise bei einer Frau der röntgenologische Fund einer Dermoidzyste (Teratom?) gemacht, die von dem rechten Ovarium ausging. Diese Geschwulst hatte nie Symptome gezeigt, und ihre Existenz war also vor der Röntgenuntersuchung unbekannt; sie konnte aber später auch durch Palpation als ein eigrosser, unempfindlicher und beweglicher Tumor nachgewiesen werden. Die Röntgendiagnose war in diesem Falle

leicht infolge Vorhandenseins einer Gruppe von wenigstens fünf Zähnen, von denen einige leicht erkennbar waren. Der Fall erinnert an den früher erwähnten von EDEIKEN.

Die Frequenz, Anzahl und Grösse der abdominellen Ovarialdermoiden und ihre röntgenologische Diagnostizierbarkeit

Vom röntgenologischen Gesichtspunkt aus ist es von grossem Interesse zu erfahren, wie oft man erwarten kann, in dem Bauche röntgenologisch diagnostizierbare Dermoidzysten anzutreffen; wie bekannt bilden diese im Bauche die dominierende Form der echten Mischgeschwülste. Man ist der Ansicht, dass sich die Ovarialdermoide auf c:a 10—13 % aller Ovarialgeschwülste belaufen (HOFMEIER resp. LUDEWIG). In einer Mitteilung aus der MAYO-Klinik wird angegeben, dass von 1 000 Spezimens 98 Dermoide waren (zit. MC CLELLAN). Diese Tumoren treten in der Regel isoliert auf, zuweilen trifft man aber zwei oder mehrere bei derselben Patientin. NOVAK (zit. KABOTH) fand einmal 21 Dermoidzysten in den beiden Ovarien einer Patientin, und KABOTH hat selbst einen Fall mit insgesamt 16 Zysten beobachtet. Nach demselben Verfasser kennt die Literatur mehr als 30 Fälle von multiplen Dermoiden. Die Zysten, die zur Operation kommen, sind in der Regel von mässiger Grösse, c:a eier- bis apfelsinengross. Bisweilen sind sie jedoch auch grösser bis mannskopfgross. Die multiplen Zysten sind oft in dem einen oder in beiden Ovarien dicht angehäuft und sind da natürlich in der Regel jede für sich klein, wenn sie auch zusammen einen grossen Tumor bilden.

In ungefähr der halben Anzahl der Fälle enthalten diese Geschwülste Zähne (KOBLANCK). Wenn man auch in Betracht zieht, dass einige von ihnen röntgenologisch sichtbare Knochenanlagen ohne Zähne enthalten — in wie grossem Prozent, ist mir nicht bekannt —, und dass vielleicht auch ein geringes Prozent dieser Geschwülste als negative Schatten diagnostiziert werden können, wagt man somit zu vermuten, dass die Dermoidzysten des Abdomens mehr oder weniger sicher in wenigstens 50 % der Fälle röntgenologisch nachgewiesen werden können.

Die Lage der Dermoidzysten. Küsters Symptom und ein Versuch, es zu erklären. Ein Faktor, der zur Stieldrehung mitwirken kann

In der Regel findet man die ovariellen Dermoidzysten, so lange sie klein sind, in dem kleinen Becken rechts oder links von der Mittellinie, je nach ihrem Ausgangspunkt. Nicht selten findet man

sie auch an einem anderen Platz im Bauche, und sie sind dann entweder durch einen Stiel mit den Adnexa verbunden, oder sie sind frei davon, sei es, dass es auf sekundärer Abschnürung beruht oder nicht. Dass sie, wenn sie an Grösse stark zunehmen, aus dem Becken emporwachsen und gleichzeitig wie alle anderen Adnexatumoren gegen die Mittellinie tendieren, ist selbstverständlich. Sie werden nämlich während ihres Zuwachses nach der Seite zu, wo der Widerstand am geringsten ist, und wo sie am meisten Raum haben, verschoben. Eine Zeitlang wurde angenommen, dass die ovariellen Dermoide eine deutliche Neigung haben, eine Medianlage vor dem Uterus einzunehmen, und dass sie nach manueller Dislozierung in diese Lage zurückfedern. Dieses von AHLFELD sogenannte KÜSTERsche Symptom ist auch in einer kleinen Anzahl Fälle von Ovarialdermoiden beschrieben worden, wo weder die Grösse des Tumors noch Adhärenzen eine gültige Erklärung für diese unerwartete Lage sein konnten. Bei gewissen fettreichen Dermoidzysten, die so leicht sind, dass sie in Wasser fliessen, scheint es mir nahe zu liegen, in ihrem geringen spezifischen Gewicht ein Moment zu suchen, das unter gewissen Umständen, wenn der Patient sich in Rückenlage befindet, zu ihrer Dislozierung mehr oder weniger median vor den Uterus beitragen kann. Alle im Becken liegenden um den Raum konkurrierenden Organe, die eine gewisse Bewegungsfreiheit besitzen (vor allem die Gedärme und die Adnexa), haben nämlich eine gewisse Neigung, sich im Verhältnis zu einander in solcher Weise zu lagern, wie es ihr spezifisches Gewicht (nicht das absolute) darbietet. Man sieht also oft, wie bekannt, auf Röntgen, wie lufthaltige Darmschlingen s. z. s. emporschwimmen, so weit der Raum und die anatomischen Verhältnisse es erlauben. Die Dermoidzysten haben zwar nie ein so niedriges spezifisches Gewicht als mit Gasen stark gefüllte Därme; ihr spezif. Gewicht kann aber niedriger sein als das der leeren oder mit Kontenta gefüllten Dünndärme. Eine solche Zyste kann sich also in aufrechter Stellung, da sie beim Gehen und bei heftigen Bewegungen der Patientin mit den umgebenden spezifisch schwereren Darmschlingen gleichwie durchgeschüttelt wird, über diese lagern und aus dem kleinen Becken in den Bauch so hoch emporsteigen, als ihre anatomische Befestigung es zulässt. Sie kann also auch in Rückenlage der Patientin in gewissen Fällen ihren Platz vor den Gedärmen und vor dem Uterus einnehmen, weil in der Gegend der Mittellinie die Wölbung der Bauch- und Beckenhöhle am höchsten ist, und die Zysten ebenso wie freies Gas im Bauch in Rückenlage dorthin streben. Das Verhältnis zwischen dem Fettgehalt der Zyste und ihrem Gehalt an schweren Knochenanlagen ist natürlich am entscheidendsten für die Abweichung in positiver oder negativer Richtung, die das spezi-

fische Gewicht der Zyste im Verhältnis zu dem der übrigen Bauchviscera aufweist. Wenn die Zyste aber spezifisch schwerer als die sie umgebenden Dünndärme ist, könnte man sich teoretisch denken, dass der Gegensatz des KÜSTERschen Symptoms entstehe, und dass die Zyste also in Rückenlage danach streben würde, sich in die Fossa Douglasi hinter dem Uterus in den tiefsten Teil des Beckens hinunterzusenken. Es ist leicht einzusehen, dass die Dislozierung einer gestielten Zyste zufolge eines von dem der Umgebung abweichenden spezifischen Gewichts begünstigt wird, wenn der Gehalt der Bauchhöhle an freier Flüssigkeit aus irgend einem Grunde zunimmt. Hier dürfte es von Interesse sein an die Ansicht NOVAKS zu erinnern, dass beim Weib um die Zeit der Ovulation eine mehr oder minder reichliche Menge freier Flüssigkeit im kleinen Becken vorhanden ist. Auch eine Stieldrehung kann Veranlassung zu einer Flüssigkeitsvermehrung geben. Wenn eine Zyste, deren spezifisches Gewicht weniger als 1 ist, durch Stieldrehung oder auf andere Weise frei geworden ist, scheint sie leicht wegen ihres niedrigen spezifischen Gewichts nach den oberen Teilen des Bauches dislozíert zu werden.

Um Missverständnisse zu vermeiden, möchte ich gleich darauf hinweisen, dass diese Deutung der Entstehung des zuweilen beobachteten KÜSTERschen Symptoms nur auf *eine* mögliche Ursache hinweist. Es gibt natürlich auch andere Ursachen für eine Verschiebung einer Dermoidzyste oder irgend eines anderen Adnexatumors nach einer Stelle vor dem Uterus oder nach den oberen Teilen des Bauches. Welches diese sind, muss in jedem speziellen Fall nachgeforscht werden. Wenn man dem spezifischen Gewicht der Zyste gewisse Bedeutung für ihre Dislozierung in die eine oder andere Richtung zuschreibt, scheint es mir, dass man auch anerkennen muss, dass der heterogene Bau der Zyste, welcher oft verschiedenes spezifisches Gewicht in verschiedenen Gebieten mit sich bringt, unter gewissen Umständen, besonders wenn die Flüssigkeit des Bauches vermehrt ist, ein beitragender Faktor einer Stieldrehung werden kann (z. B. bei Drehungen der Patientin in liegender Stellung). Der spezifisch schwerere Teil der Zyste (der Dermoidzapfen mit seinen Knochen und Zahnanlagen) neigt nämlich immer und besonders wenn die Bauchflüssigkeit vermehrt ist, dazu, sich unter den fettreichen Zysteninhalt zu legen. Wenn aus diesem Grunde die Zyste bei der Drehung des Körpers nicht passiv eben so viel wie dieser gedreht wird, muss dies eine mehr oder weniger ausgesprochene Stieldrehung zur Folge haben. Auch ist es denkbar, dass eine Drehung des Körpers, die schnell gehemmt wird, eine fortgesetzte Rotationsbewegung der Zyste wegen verschiedenes spez. Gewichts und Trägkeit der verschiedenen Teile der Zyste begünstigen kann.

Knochenanlagen und Zähne der Dermoide

Für die Röntgenologen ist es diagnostisch wertvoll zu wissen, wie diese Bildungen in den Dermoidzysten und in damit verwandten Tumoren aussehen. Die Knochenanlagen sind meistens klein und unregelmässig mit dichteren und dünneren Gebieten. Oft haben sie undeutliche Ausläufer. Meistens kommen sie isoliert vor. Bisweilen gleichen sie einem gewissen Knochen, am häufigsten einem Gesichtsknochen, z. B. einem Alveolarfortsatz, einem Os maxillaris oder Os praemaxillaris, wobei Zähne das Identifizieren der Knochenart leichter machen. Selten trifft man Extremitetenanlagen und noch grössere Teile eines Fötus. Steinhoff glaubte feststellen zu können, dass meistens in ein und derselben Zyste nur Zähne ein und derselben Seite vorhanden wären, entweder nur Zähne der rechten oder nur der linken Kieferhälfte. Auch wenn dies meistens der Fall zu sein scheint, sind doch nicht wenige Ausnahmen von dieser Regel in der Literatur vorgelegt worden (siehe z. B. Trauner und W. Schmidt).

Die Zähne der Dermoide entwickeln sich im wesentlichen nach denselben Gesetzen wie die normalen (Meckel). I. J. 1923 hat Steinhoff eine eingehende Studie über diese Zähne vorgelegt, die auch für die Röntgenologen von grossem Interesse ist, weil ab und zu nur eine eingehende Kenntnis dieser Zähne eine praeoperative Diagnose möglich macht. In 19 von S. näher studierten Fällen zahnführender Dermoide enthielten neun Zysten nur 1, zwei 2 Zähne, eine 3 Zähne, vier 4 Zähne, eine 5 Zähne, eine 7 Zähne und eine 11 Zähne resp. deren Anlagen. Von den in dem Akadem. Krankenhaus röntgenuntersuchten, zahnführenden Geschwülsten enthielten drei je einen röntgenologisch leicht erkennbaren, gut entwickelten Zahn. Es waren in zwei dieser Fälle zwar 2 resp. mehrere Zähne vorhanden, aber von diesen konnte bei der Röntgenuntersuchung nur einer mit Sicherheit als ein Zahn identifiziert werden, weil der andere resp. die übrigen weniger gut entwickelt waren, und in dem einen Fall die Zähne ausserdem von der dichten Knochenmasse, in der sie steckten, verdunkelt wurden. In 2 dieser Fälle hatten die Zähne eine sehr unbedeutende Knochenmatrix. In dem dritten Fall (Nr. 5 in der Kasuistik), der nicht operiert worden ist, können mit Sicherheit vier Zähne beobachtet werden. Eine fünfte ersichtliche, unentwickelte Zahnkrone kann nur wegen der naheliegenden mehr entwickelten Zähne identifiziert werden. Die Knochenmatrix, in der diese Zähne stecken, tritt auf den Platten sehr undeutlich hervor und ist von geringer Dichtheit, von einem schmalen Verdichtungsstrich abgesehen, der eines der Zahnfächer begrenzt, und der auch normal ringsum die in Entwicklung stehenden Zähne deutlich ersicht-

lich zu sein pflegt. Aus der Statistik STEINHOFFS geht nicht hervor, wie viele der darin aufgenommenen Zähne resp. Zahnanlagen so gut entwickelt waren, dass sie auch beim Photographieren in vivo als Zähne hätten erkannt werden können und auch nicht, in wie grossem Prozent eine sichere Röntgendiagnose möglich gewesen wäre, wenn die Fälle vor der Operation oder der Sektion zur Untersuchung gekommen wären.

In den Fällen, wo zwei oder mehrere Zähne resp. Zahnanlagen vorhanden sind, wird die Diagnose natürlich schon durch das Nachweisen eines Zahns klargelegt. Auch wenn es ein gut entwickelter und wohlgebildeter Zahn ist, dürfte es doch zuweilen auf Schwierigkeiten stossen können, ihn zu erkennen, wenn er z. B. in einer ungeeigneten Strahlenrichtung projiziert worden ist.

Röntgendiagnostisch sehr interessant ist der Nachweis STEINHOFFS, dass in einer grossen Anzahl der Fälle isolierte Zähne zur Entwicklung kommen (in c:a 50 % seiner 19 Fälle). Die in der Literatur vorliegende Kasuistik spricht in derselben Richtung. Mit Rücksicht auf die Differenzialdiagnose zwischen Konkrementen des Harnapparats, besonders Uretersteinen, und anderen konkrementähnlichen Schatten vor allem des kleinen Beckens ist es von grosser Bedeutung sich dieses Umstandes zu erinnern, sowie auch der Tatsache, dass eine umgebende Knochenmatrix, wenn eine derartige vorhanden ist was durchaus nicht immer der Fall ist (siehe unten), oft sehr undeutlich oder gar nicht hervortritt.

In vereinzelten Fällen sind unglaublich grosse Mengen von Zähnen bis über 300 in Dermoiden angetroffen worden. Die meisten sind dann wenig entwickelt, und es kommen zahlreiche Zahnscherbchen vor. Die meisten Zähne sind in der Regel in den grösseren Geschwülsten vorhanden (STEINHOFF). In den meisten Fällen finden sich nur Zähne der zweiten Dentition, ganz vereinzelt nur Milchzähne oder beide Arten gemischt; bisweilen kann die Art des Zahns nicht bestimmt werden.

Nach STEINHOFF werden am häufigsten Backenzähne, demnächst Schneidezähne und am wenigsten oft Eckzähne angetroffen. Die Zähne haben in der Regel nicht ihre volle Entwicklung erreicht; so fehlen oft die Wurzeln in grösserem oder kleinerem Umfang, und bisweilen ist nur die Kaufläche aufgebaut worden. Es kann natürlich äusserst schwer sein, einen so unvollständig aufgebauten Zahn zu identifizieren, besonders wenn er isoliert ist, und wenn die Strahlenrichtung nicht günstig gewesen ist.

Wenn die Wurzeln der mehrwurzeligen Zähne entwickelt sind, pflegt man sie in normaler Anzahl zu finden, aber meistens sind sie zusammengewachsen (HARRES, STEINHOFF). Nach BÖTTLIN werden

Anomalien der Zähne in Dermoiden häufiger angetroffen als im Munde. So sieht man bisweilen verwachsene und Zwillingzähne, Zapfenzähne und Zahnrudimente (HARRES). In einigen Fällen hat STEINHOFF beobachtet, dass der Schmelz teilweise fehlte oder so weich war, dass man ihn leicht abkratzen konnte. Gewöhnliche Resorbtionsphänomene sieht man oft, besonders bei Milchzähnen. Wenn man Zähne verschiedener Zahnarten antrifft, sind nach HARRES die Schneidezähne am meisten entwickelt, während Eckzähne und Bicuspidaten den Molaren voraus sind. Wir haben also hier dieselben Verhältnisse, wie sie im Munde angetroffen werden.

Die Befestigung der Zähne in den Dermoiden ist nach STEINHOFF verschieden. »Stehen eine grosse Anzahl eingekeilt in Alveolen, die teils verknöchert, teils erweicht, teils mehr knorpelig sind, so stehen auch viele in der Zystenwand oder sind auch ganz in dieselbe eingebettet. Wieder andere sind von Bindegewebe umschlossen, aus dem die Kronen hervorragen wie aus der Gingiva. Vereinzelte sind in einem bindegewebigen Säckchen eingeschlossen und mit der Wand oder der Wulst durch ein Bändchen oder ein Kordelähnliches Gewebe verbunden.» Es ist also vom röntgenologischen Gesichtspunkt aus interessant, dass nur einige der Zähne von Knochengewebe umgeben sind, so dass sie sich deshalb oft, wie schon oben erwähnt worden ist, als in Weichteilen liegende Körper zeichnen.

Bisweilen liegen die Zähne ganz frei und beweglich innerhalb der Zyste, nachdem sie in irgend einer Weise von ihrer Matrix losgemacht worden sind. SCHMIDT gibt an, dass dies nicht selten der Fall ist. Bisweilen kann ein sichtbarer Zahn oder ein Knochenstück auch unter anderen Umständen sich als ein freier beweglicher Körper zeigen, wenn nämlich eine Zyste abtorquiert worden ist. und wenn diese, wie es zuweilen beschrieben wird (z. B. von KABOTH), eine freie Beweglichkeit innerhalb der Bauchhöhle behalten hat, oder wenn sie einen langen Stiel und deshalb grössere Verschieblichkeit als normal besitzt. Man dürfte aber damit rechnen können, dass auch unter gewöhnlichen Verhältnissen ein kalkdichter Schatten in einer Dermoidzyste, die von den Adnexa ausgeht, meistens, wenn Adherenzen nicht vorliegen, eine rel. grosse Verschiebbarkeit hat, grösser als die eines Uretersteins. Wenn ein unsicherer Zahnschatten in der Gegend eines Ureters angetroffen wird, könnte dieser Umstand zu diagnostischem Zweck ausgenutzt werden, wenn das Einlegen eines Ureterkatheters aus irgend einem Grund nicht in Frage kommen kann.

Einige Krankheiten, mit denen Dermoidzysten und damit nahe verwandte Geschwülste verwechselt werden können

Die Dermoidzysten verursachen in der Regel keine Beschwerden, wenn sie klein sind. Solche entstehen erst, wenn die Tumoren eine gewisse Grösse erreicht haben, oder wenn eine Stieldrehung oder eine Infektion des Zysteninhalts entsteht. In diesen beiden letzteren Fällen kann leicht eine Verwechslung mit Appendizitis oder einem anderen inflammatorischen Prozess stattfinden. Dass gestielte Ovarialgeschwülste überhaupt und besonders häufig Dermoide bei Stieldrehung Anlass zu Verwechslung mit akuter Perityplitis geben können, ist allbekannt (KAREWSKI u. a.). Diagnostische Schwierigkeiten entstehen besonders, wenn die konsekutive Exsudation in der Bauchhöhle und die Darmlähmung bereits grossen Umfang angenommen haben, so dass der Tumor schwer zu palpieren ist. In dem obenerwähnten Fall (Nr. 4 der Kasuistik) hatte die Exsudation eine solche grosse Ausbreitung, und die Diagnose war ausserdem dadurch erschwert, dass die Zyste infolge der Gravidität auf die Appendixgegend dislociert worden war. In diesem Zusammenhang dürfte von Wert sein, daran zu erinnern, dass die Ovarialdermoide allgemeiner Erfahrung nach oft während des Puerperium infiziert werden. Eine Infektion der Zyste kann bisweilen auch zu der Diagnose Salpingitis Anlass geben. Bei Perforation einer Dermoidzyste, infiziert oder nicht, in die Bauchhöhle, kann eine abgekapselte oder diffuse Peritonitis entstehen. Die Zyste kann sich auch bisweilen nach aussen entleeren, z. B. in die Gedärme (oft durch Rectum), in die Vagina oder in die Harnblase. Die akuten Bauchsymptome, die bei Stieldrehung entstehen, können auch zu Verwechslung mit anderen akuten Bauchaffektionen, z. B. mit Nierensteinkolik, Anlass geben. Die klinischen Symptome können in diesen Fällen denen eines Harnwegkonkrements täuschend ähnlich sein, was besonders der von ALEXANDER publizierte Fall lehrt. Mit Harnleiterkonkrementen sind auch mehrmals röntgenologisch beobachtete Knochen- und Zahnbildungen in Dermoiden verwechselt worden (Lit. siehe LAURELL).

Verwechslungen mit Nierentumor, Hydronephrose, beweglicher Niere und extrauteriner Schwangerschaft sind zu verschiedenen Malen vorgekommen. Wenn die Dermoidzyste im oberen Teil des Bauches gesessen hat, sind auch andere Fehldiagnosen vorgekommen, z. B. Mesenterialzyste, vergrösserte Gallenblase, Cancer ventriculi u. s. w. In dem Fall Nr. 1 der obenerwähnten Kasuistik ging die Diagnose in erster Linie auf einen Magenkrebs, ehe die Röntgenuntersuchung den Fall klargelegt hatte.

Nicht selten haben Dermoide zu Geburtshindernis, bisweilen auch zu Darmhindernis, Veranlassung gegeben.

In den Fällen, wo die obenerwähnten Erkrankungsbilder oder kränklichen Zustände von Dermoidzysten und damit verwandten Geschwülsten hervorgerufen worden sind, kann eine Röntgenuntersuchung in einem grossen Prozent der Fälle für die Diagnose Dermoidzyste ausschlaggebend sein. Die rein klinische Diagnose ist nämlich meistens sehr schwer und kann nur in gewissen Spezialfällen ganz sicher gestellt werden, wenn z. B. typischer Dermoidinhalt nach Perforation abgegangen ist, oder wenn knochenharte Teile in einem zystischen Tumor gefühlt werden können, und vor allem wenn man gleichzeitig eine Krepitation hervorrufen kann; eine derartige entsteht, wenn die Zyste mehrere Zähne enthält, die man zu einem Reiben gegen einander bringen kann.

ZUSAMMENFASSUNG

Der Verfasser hat in zwei verschiedenen Aufsätzen die von ihm angetroffene Röntgenliteratur der Dermoidzysten und der mit diesen naheverwandten Tumoren vor allem des Abdomens zusammengestellt.

In dem Akademischen Krankenhaus zu Uppsala sind während der letzten 10 Jahre fünf Fälle solcher Geschwülste röntgenuntersucht worden; in drei dieser Fälle war Röntgen für die Diagnose ausschlaggebend.

Die röntgenologische Diagnose wird hauptsächlich auf das Vorkommen von Knochen und Zähnen gegründet. Dem Verhalten derselben wird deshalb besondere Aufmerksamkeit geschenkt.

Die Ansicht des Verf:s ist, dass das niedrige spezifische Gewicht gewisser fettreichen und beweglichen Dermoidzysten bisweilen ein beitragender Faktor für ihre Dislozierung in der Bauchhöhle ist. Das s. g. KÜSTERsche Symptom u. a. kann dadurch *eine* Erklärung finden.

Verf. weist auch darauf hin, dass verschiedene Teile der Zyste verschiedenes spezifisches Gewicht haben können, und meint, dass dies Verhalten unter gewissen Umständen eine Pedunkeldrehung begünstigen kann.

SUMMARY

In two separate articles the writer has brought together the roentgen literature accessible to him on dermoid cysts and tumours closely related thereto, especially in the abdomen.

In the academical hospital at Uppsala during the last ten years five cases of such tumours have been roentgenologically examined, and in three of these cases the roentgen examination played a decisive part in the diagnosis.

The roentgenological diagnosis is mainly based on the occurrence of bones and teeth. Moreover special attention is devoted to the condition of these.

The writer's view is that the lower specific gravity of certain fatty and movable dermoid cysts is sometimes a contributary factor for their dislocation

into the abdominal cavity. What is known as the KÜSTER symptom etc. can thus find *one* explanation.

The writer has also found that different parts of the cyst may have a different specific gravity, and he thinks that this circumstance may under certain conditions favour a torsion of pedicle.

RÉSUMÉ

L'auteur a réuni, dans deux études distinctes, la littérature röntgenologique qu'il a pu trouver sur les kystes dermoïdes ou les tumeurs proches parentes, siégeant surtout dans la cavité abdominale.

Au cours des 10 dernières années, cinq cas de ce genre ont été, à l'hôpital universitaire d'Upsal, l'objet d'un examen röntgenologique: dans trois de ces cas la radiographie fut décisive au point de vue diagnostic.

Le diagnostic radiologique est avant tout fondé sur la présence d'os ou de dents; aussi accorde-t-on la plus grand attention à l'existence de ces formations.

L'auteur estime que le faible poids spécifique de certaines kystes dermoïdes riches en graisse et mobiles peut être considéré comme un facteur adjuvant de leur dislocation dans la cavité abdominale. Le signe dit »de KÜSTER» trouve ainsi au moins *une* explication.

L'auteur rappelle que les différentes parties d'un kyste peuvent avoir un poids spécifique différent, et pense que cette circonstance est, dans certaines conditions, de nature à favoriser une torsion du pédicule.

LITERATUR

ALBERS-SCHÖNBERG, ASSMAN, EDEIKEN, EDLING, JOSEPHSON, KÄSTLE, LEXER, PAYER, POWELL and HARTLEY, SAXER, SONNTAG, HOLLAND, WEIL und WILMS siehe näher Acta radiologica 1922. S. 417.

AHLFELD, F.: Über die Lage der Dermoidcysten zum Uterus. Zentralbl. f. Gynäkologie. 1892. S. 227.

AIME, P.: Le diagnostic radiologique des Kystes dermoides de l'ovaire. Journal de Radiologie. 1925. S. 236.

ALEXANDER, H.: Die Vortäuschung eines Uretersteins durch den Zahn eines Ovarialdermoids. Zeitschr. f. urolog. Chirurgie. 1924. S. 163.

BÖTTLIN: Über Zahnentwickelung in Dermoidcysten des Ovariums. Virchows Archiv. 1889.

CASSUTE, B., et de BEAUJEU, J.: Kystes dermoïdes des deux ovaires. Revue tunisienne des Sciences Médicales. 1924.

FAGGE, C. H.: Bilateral ovarian dermoid cysts simulating renal colic. Brit. Journ. Surg. 1919. S. 468.

FREUND, H.: Die Lage der Ovarialdermoide zum Uterus. Zentralbl. f. Gyn. 1892. S. 609.

GOSSET, M.: Kyste dermoïde de l'ovaire droit avec productions dentaires décelées à la radiographie et pouvant faire penser à un calcul de l'uretère droit. Société de chirurgie. Bd. 39. 1913.

Gottschalk, S.: Über die Lage der Dermoidcysten zum Uterus. Zentralbl. f. Gynäkol. 1892. S. 303.
Harres cit. Steinhoff: Über Zähne in Dermoidcysten. 1892.
Hofmeier, M.: Frauenkrankheiten. 1908.
Kaboth, C.: Über multiple Dermoide der Ovarien. Zentralbl. f. Gyn. 1924. S. 2678.
Karewski, F.: Appendicitis vom Standpunkt der Chirurgie. Kraus u. Brugsch. 1923.
Koblanck, A.: Erkennung und Behandlung der Eierstockskrankheiten. Die deutsche Klinik. Bd. 9, 1904. S. 792.
Latzko, W.: Zur Frage des sog. »Küsterschen Zeichens». Zentralbl. f. Gyn. 1892. S. 936.
Laurell, H.: Ein Beitrag zur Röntgenologie der echten Mischgeschwülste des Rumpfes. Acta radiologica. 1922. S. 406.
— Some Cases of volvulus. Proceedings of the Nordisk Förening för medicinsk radiologi, Stockholm 1923. Ref. in Acta radiologica 1924. S. 213.
Ludewig, G.: Über Dermoidcysten der Ovarien. Inaug.-Diss. Breslau 1920. Ref. Zentralbl. f. Gyn. 1921.
Mc Clellan, B.: Americ. Journal of Obstetr. and Gynecol. 1921. S. 493. Ovarian dermoid cysts: Etiology, Diagnosis and Treatment.
Meckel: Archiv f. Physiologie. 1815. Zit. Trauner.
Novak, J.: Über Ursache und Bedeutung des physiologischen Ascites beim Weibe. Zentralbl. f. Gynäkologie. 1922. Bd. 46. S. 854.
Novak cit. Kaboth.
Odqvist, H.: Vortrag bei der Tagung der schwedischen Radiologen in Stockholm im Mai 1924.
Pless: Röntgenologisch diagnostizierte Dermoidcyste. Klin. Wochenschr. 1923. S. 1074. Ref. Fortschr. d. Röntgenstr. Bd. 30. S. 359.
Schmidt, L.: Beitrag zur Histologie der Knochen und Zähne in den Dermoidcysten der Ovarien. Deutsch. Monatschr. f. Zahnheilkunde. 1890. S. 1.
Schmitt, W.: Ueber Dermoidcysten des Ovariums. Zeitschr. f. Geburtsh. u. Gynäk. 1923. S. 629.
Steinhoff, J.: Über Zähne in Ovarialteratomen. Arch. f. Gynaekol. Bd. 116, 1923.
Trauner, Fr.: Über Dermoide des Ovariums mit besonderer Berücksichtigung der Zähne in denselben. Deutsch. Monatschr. f. Zahnheilkunde. 1903. S. 561.

FROM THE FINSEN PHOTOTHERAPEUTICAL INSTITUTE (DEP'T FOR SKIN DISEASES, HEAD PHYSICIAN: DR. REYN), COPENHAGEN

INVISIBLE CHANGES IN THE X-RADIATED SKIN. AN EXPERIMENTAL STUDY

by

H. Haxthausen, M. D.

The idea of undertaking the investigations, which form the subject of the present communication was suggested to me some time ago by the fact that in a number of instances I had observed relapses of eczema in patients who had previously been treated with X-rays.

What particularly attracted my attention was the circumstance that, in several of the cases referred to, the appearance and whole development of these relapses seemed to differ, in various respects, from what might be termed the average course of corresponding cases that had not, like these, been X-radiated; a condition, by the way, which was already alluded to by RASCH, in his "Hudens Sygdomme", in 1909.

As variations from the normal picture of such cases I believe to have observed, in the first place, a more rapid development and spread than usual, of the eczematous process itself; in the second place, a hyperemia both absolutely and relatively stronger than observed in corresponding eczemata on skin not previously subjected to X-radiation; and finally, a remarkable intolerance to all conservative treatment with cataplasms, ointments, and the like.

It is true that the two first-named circumstances, which after all represent, in the main, merely quantitative variations from the habitual picture, furnish but the vaguest possible grounds for supposing the once irradiated skin to have acquired a higher degree of irritability; but the third of the features observed — the intolerance to agents which in ordinary cases of eczema not only are supported but nearly always have a decidedly curative effect — undoubtedly denotes (provided, of course, that the observation itself is correct) a manifest, qualitative difference from cases of eczema that have not been subjected to the rays.

Now it must straightway be admitted that these clinical observations have been made only in a minor proportion of the cases where the eczema had been treated with X-rays, and that their direct value as evidence, therefore, is not particularly great, especially when it

is considered how largely the estimation of the symtoms, and the importance attached to them, depends upon the individual judgment of the observer; and to this must be added, as a circumstance reducing their value still further, the fact that — in Denmark, at least — it is chiefly the grave and particularly refractory forms of eczema that are treated by X-rays.

Still, in spite of all these reservations, the clinical facts that had aroused my attention seemed so calculated to excite suspicion as to some possible effect of the X-radiation, whereby the skin might become affected in a manner prejudicial to the course of a subsequently relapsing eczema, that I decided to investigate the matter experimentally. I was further encouraged in this purpose by having my observations confirmed from several other sides, and more so when I came to compare them with what we already know concerning the action of light-rays on the skin, and the bearing of this action on the eczematous process. As regards the latter, there is no doubt but that repeated irradiation in many cases predisposes the skin to eczema in such a manner that not only does the repeatedly irradiated area become a site of predilection for the eruptions, but that these eruptions also become more protracted and yield less easily to treatment. Now, it will always be impossible, of course, to reproduce experimentally the exact conditions obtaining in a true case of eczema; but nevertheless there are several ways in which the problem can be approached, and which, even if they are necessarily incomplete, may possibly be of some interest in view of the enormous importance that attaches to knowing whether X-radiation, with the therapeutical doses usually employed, contains an element of risk in the way of preparing the way for eventual eczematous manifestations, later on.

The task which I set myself, then, was to find out whether alterations in the skin, experimentally provoked and of a character resembling those occurring in cases of true eczema, would have a different appearance and show a different course of development in skin that had already been subjected to X-radiation, than in the normal skin.

Among the experimentally producible alterations of which there could be question in this connection I chose two which, each in its own way, present certain advantages for an investigation of this kind, at the same time as they may be taken to supplement one another quite naturally.

For one object of experimentation I chose the light-erythema, which, in the first place, is easy to operate with, and in the second place offers the great advantage that it is possible to produce all the transitions from the slightest to a very strong erythema, and

even, if so desired, to bullous reactions. It might be objected, against the suitability of the light-erythema as a testing-object in the present connection, that as a matter of fact it has relatively little in common with the nature of an eczema; still, although this may be true, it can give us information on one very essential point; namely, as to the capillaries and concerning the condition of the whole vasomotorial apparatus in the skin; because it is reasonable to presume that a (so to speak) "latent" impairment of these elements, caused by the X-radiation, will have a characteristic bearing on the intensity and course of a light-erythema produced in the same situation.

For my second object of experimentation I chose the dermatitis which occurs as a result of croton oil being rubbed into the skin. I did not employ the croton oil pure, but as a 5 per cent. solution in lanolin which, by a brief inunction for a few successive days into the same area, causes an affection so closely akin to an acute, vesicular eczema that, as a matter of fact, it may well be asserted that it *is*, in truth, an eczema which has been produced in this manner. The reaction shows in a more or less strong hyperemia, which, especially in the beginning, is decidedly follicular; a circumstance which is due to the fact that the penetration of the croton oil into the skin takes place chiefly through the orifices of the follicles. If the inunctions are continued there will appear, in addition to this erythema, numerous miliary vesicles similar to those that mark the ordinary, acute eczema; and finally there will be an eruption of pustules, also chiefly surrounding the follicles.

By following these two lines of investigation it is, consequently, possible to study, in the first place, the condition of the capillaries; and, in the second place, the tendency of the skin to form vesicles and pustules; and if the *X*-ray treatment should have caused any changes in the skin with respect to these two points, it is not unreasonable to expect that they would become distinctly manifest in the course of these investigations.

The carrying out of the researches here outlined requires, however, that the investigator should have at his disposal, as subjects for study, a number of cases in which clearly defined, healthy areas of skin have been exposed to X-radiation under conditions that will enable him to compare these irradiated areas with others, contiguous to them and of exactly similar nature, but non-irradiated.

I have had the good fortune to find material of this description in the many cases of struma and BASEDOW's disease under X-ray treatment at the Finsen institute throughout the period during which my studies of this problem have been undertaken. I take this opportunity to thank Dr. REYN, the Head Physician, for kindly

permitting me to make use of these cases as material for my investigations.

The cases here mentioned were all being treated according to an established routine, which consisted in irradiating a field on each side of the patient's neck and a third one on his chest, in a situation corresponding with the thymus; the area of each of these three fields being limited by means of a circular "localisator" 8 cm. in diameter. It cannot be avoided of course, that by repeated irradiation the contours of these circular fields will gradually become somewhat vague, owing to the impossibility of making the localisator hit the original demarcation line with absolute exactness at each repetition; but nevertheless it is possible to count, all the time, with these three fairly well defined, more or less circular patches, the size and situation of which are known, and between which there are large surfaces of skin hardly different from the skin of these patches except in the one respect that the latter have been subjected to the X-rays, and the rest of the skin has not.

The dosage used in these cases was the same all through; namely, 1 S.-N. through a 4 mm. aluminium filter, repeated a varying number of times with intervals of from 1 to 2 months. Among my cases all stages are represented: from such as had only 1 irradiation to those who had received 12; the latter figure representing the maximum of treatment in any of the cases examined; while in the majority of cases the number of irradiations had been from 4 to 6.

It will be noticed that the individual dose is only one fourth to one third as large as the erythema dose; and inasmuch as the intervals between irriadiations were in most of the cases over one month, we have, in reality, to do with an application of X-ray quantities which can not by any means be said to exceed those commonly employed in the treatment of eczema. It is true that, in the present case, the rays are of a somewhat harder quality than those usually employed in cases of eczema; but from all that we know this fact should not, as regards the skin, make any very noticeable difference. It is therefore permitted to say that these cases lent themselves excellently to the study of possible X-ray changes resulting from irradiations whose intensity fall within the range of the therapy prescribed and commonly accepted for cases of eczema.

Owing to this relative feebleness of the irradiation, not one of my cases showed *visible* signs of X-ray changes beyond a slight pigmentation of the circular fields, and this only in some of the cases, even. There was no instance either of teleangiectasis or of atrophy; but as I wished to put also these graver forms of alteration in the skin to the test of the experimental methods just described,

I brought the latter to bear on some cases of adenitis tub. colli, in which such directly visible X-ray changes, due to a somewhat intense irradiation, were found over restricted areas of the skin. In the same category of cutaneous alterations I have, furthermore, investigated some cases of eczema and of neurodermatitis.

As regards the outcome of the investigations, let us look first at the observations resulting from the experimental production of light-erythema in the X-radiated portions of the skin. The proceeding here consisted in irradiating the middle of the chest and the sides of the neck over a space embracing the circular field already X-radiated + a suitable expanse of the surrounding skin. The irradiation was done by means of a mercury-quartz lamp from a distance of 35 cm. The time of exposure varied somewhat according to the general degree of pigmentation of the subject experimented on; my endeavour being to produce a distinct, still rather slight erythema, because it is to be supposed that eventual differences in the strenght of the erythema on, respectively, X-radiated and normal skin will be most easily recognisable if the erythema is only a slight one. The record of the result was based, in each case, on the observation made of the erythema the following day; and as a rule it was again observed a few days later, and once more after some weeks.

The light-erythema test was tried on altogether 28 of these previously X-radiated cases. In 13 of them the erythema was absolutely uniform over the whole of the areas irradiated; that is, no difference whatsoever could be observed between the effect on the previously X-radiated skin and the normal one.

In the remaining 15 cases the result was different. In nearly all of these — that is, in 14 out of the 15 — there was a more or less marked accentuation of the light-erythema in the previously X-radiated fields. In 5 cases this accentuation was observed in all the three fields; in 3 cases in the fields of the neck only; and i 4 cases in the thymus field only. In two cases there was no visible difference during the first few days after the irradiation had taken place; but later on, when pigmentation commenced, the latter became markedly stronger in the fields that had already previously been subjected to X-radiation. In one case the erythema of the X-ray fields differed from that of the surrounding skin by showing an abundant scattering of tiny teleangiectasias which, however, disappeared later on. One case, finally, gave a paradoxical reaction: the X-ray field standing out pale against the surrounding light-erythema. There had been no visible difference, beforehand, between the previously X-radiated and the normal skin in this case; and it should be stated expressly

that there was no visible pigmentation of the X-ray field previously to the experiment. —

The second group — the experiments with croton oil — comprised a total of 32 cases. In 19 of these the vesicular and pustular dermatitis produced by inunction with the oil was uniform for the irradiated and the non-irradiated skin; in 5 cases both the erythema and the folliculitis were stronger in the X-ray fields; in 6 the erythema alone, and in 2 the folliculitis alone was stronger in the last-named areas.

When croton oil was rubbed into skin that had already undergone visible X-ray changes manifesting themselves in teleangiectasis and atrophy, the reaction showed itself in a dermatitis which was strongest in the healthy skin surrounding the seats of these X-ray lesions. At the first glance this may appear paradoxical; but after all it should be no matter for surprise, when we stop to consider that, of course, the croton oil penetrates less easily where the follicles are partly or entirely destroyed.

If, now, we review results, it will be seen that in about one half of the cases the X-radiated skin reacted differently from the normal skin to a like application of two distinct and separate exterior irritants; a fact which must be interpreted as denoting an increased irritability of the X-radiated skin. To prove any connection between the positive results of these tests and the intensity of the preceding irradiations to which these cases had been subjected has been impossible, because among those which reacted positively there were several in which only one or two irradiations had been given, while, on the other hand, among those that reacted negatively there were several cases of many previous irradiations. On the whole, the changes demonstrated, though distinct, have been but feebly pronounced; but however slight in themselves they show us, nevertheless, that the irritability — or whatever we chose to call it — of the skin can be hightened by exposure to X-radiation in such doses as fall within the accepted practice of X-ray therapy as applied to cases of eczema. I do not wish to assert, of course, that this is indeed the explanation of the conditions which I believe I have observed in connection with relapses of eczema after X-ray treatment; but I see in the facts brought out by the investigations here recorded an urgent call for future investigators to make a close clinical study of these relapses, particularly with a view to finding out whether the X-ray dosage in cases of eczema ought not possibly to be reduced to a strength somewhat inferior to that of the doses now commonly employed, at least in a good many places.

SUMMARY

Starting from the observation that recurrences in roentgenologically treated eczemas are often very obstinate and irritable, the author has experimentally investigated the question whether normal skin after X-Radiation becomes less resistant to external irritations.

The experiments were carried out with patients suffering from goitre and exophthalmous goitre, three circular parts on the neck and the uppermost part of the chest being radiated from one to twelve times with 1 Sab. w. 4 mm. Al.-filter, with 1—2 months interval between the treatments. Except for a slight pigmentation in some of the cases, there were found no visible roentgenological changes of the skin.

In 28 cases there was produced, with the help of the mercury quartz lamp, a light erythema on the x-radiated fields and a suitable area of the surrounding skin. In 13 of these cases the erythema was uniform over the whole skin; in 14 cases it was stronger on the x-radiated skin; in 1 case it was weaker.

In 32 cases dermatitis was caused on rubbing in a 5 % crotonolic ointment. In 19 of these cases there was no difference between the X-radiated and the normal skin; in 13 cases the dermatitis was strongest on the roentgen fields.

No certain relation can be shown between the intensity of the roentgen treatment and the positive reaction in the experiment.

The experiments show that X-radiated skin, even if the dose falls within the limits of eczematous therapy, and where there are no direct visible changes, reacts in a large number of cases more strongly than normal skin to external irritations.

ZUSAMMENFASSUNG

Ausgehend von der Beobachtung, dass die Rezidiven bei röntgenbehandelten Ekzemen oft sehr hartnäckig und irritabel sind, hat der Verf. experimentell untersucht, ob normale Haut nach Röntgenbestrahlung gegen äussere Reize weniger widerstandsfähig wird.

Die Versuche wurden an Struma- und Basedowpatienten ausgeführt, wobei 3 kreisrunde Partien am Halse und am obersten Teil der Brust 1—12 mal unter Einschaltung von je 1—2 monatigen Pausen zwischen den Behandlungen mit 1 Sab. m. 4 mm Al-Filter bestrahlt wurden. Ausser einer leichten Pigmentierung bei einigen Patienten fanden sich keine sichtbaren Röntgenveränderungen der Haut.

Bei 28 Fällen wurde mit Hilfe der Quecksilberquarzlampe ein Lichterythem auf den röntgenbehandelten Feldern sowie auf einem entsprechenden Areal der umgebenden Haut hervorgerufen. Bei 13 von diesen Fällen wurde das entstehende Erythem über seine ganze Ausdehnung gleichmässig stark, bei 14 af den röntgenbestrahlten Hautpartien stärker, bei 1 Fall schwächer.

In 32 Fällen wurde durch Einreiben einer 5 % Crotonölsalbe eine Dermatitis hervorgerufen. Bei 19 von ihnen zeigte sich dabei kein Unterschied zwischen röntgenbehandelter und normaler Haut, bei 13 Fällen war die Dermatitis auf den Röntgenfeldern stärker.

Ein sicheres proportionelles Verhältnis zwischen der Intensität der Röntgenbehandlung und der positiven Reaktion beim Experiment lässt sich nicht nachweisen.

Die Versuche zeigen, dass mit einer Dosierung, die innerhalb des Rahmens der Exzemtherapie fällt, röntgenbehandelte Haut, wenn sie auch keine direkt sichtbaren Veränderungen zeigt, doch in einer grossen Zahl von Fällen gegen äussere Reize stärker reagiert, als normale Haut.

RÉSUMÉ

Ayant constaté que les récidives d'eczéma traités par les rayons X sont particulièrement tenaces et irritables, l'auteur s'est préoccupé de rechercher par la voie expérimentale si la peau normale est, après irradiation par les rayons X, moins résistante aux irritations extérieures.

Ces expériences ont été faites chez des goitreux ou des basedowiens, chez lesquels 3 régions circulaires du cou et de la partie supérieure de la poitrine ont été irradiées de 1 à 12 fois avec 1 Sab. et 4 mm. Al., et avec un à deux-mois de repos entre chaque traitement. En dehors d'une légère pigmentation, on n'observait aucune modification apparente de la peau consécutive à l'usage des rayons X.

Dans 28 cas, on provoqua, à l'aide de la lampe à quartz, un érythème d'insolation sur les champs préalablement irradiés ainsi que sur une surface appropriée de peau environnante. Dans 13 cas l'érythème était uniforme dans toute l'étendue de la peau traitée; dans 14 cas, il était plus marqué sur la peau irradiée, et dans un cas, plus faible à ce niveau.

Chez 32 malades, on provoqua une dermatite, par des frictions avec de l'huile de croton. Dans 19 cas, on n'observait aucune différence entre la peau irradiée et la peau normale; dans 13 cas, la dermatite était plus intense dans les champs irradiés.

On ne peut établir avec certitude aucune relation entre l'intensité du traitement par les rayons X et la réaction positive des expériences.

Les expériences réalisées montrent qu'une peau irradiée aux rayons X, à des doses thérapeutiques anti-eczémateuses, et où on n'aperçoit aucune modification de la peau, réagit cependant dans un grand nombre de cas, d'une façon plus intense aux irritations exterieures qu'une peau normale.

FROM THE ROENTGEN INSTITUTE OF THE ROYAL SERAFIMER HOSPITAL.
CHIEF: PROFESSOR GÖSTA FORSSELL

APPARATUS FOR PRECISE RADIOGRAPHY

by

Erik Lysholm
Chief Assistant

(Tabula XXXII)

For the investigation of the skeleton system and of the urogenital apparatus this Institute, like other roentgen departments in Sweden has made use of the table which in its original form was brought out by ALBERS-SCHÖNBERG of Hamburg and which has since been improved by Professor FORSSELL. For certain difficult functions, however, this table has proved to be not very suitable, and consequently attempts have been made to devise more precise arrangements. In the course of this work it has proved advantageous to have one special apparatus for roentgenological examination of the cranium and another for the examination of other parts of the body and of the cranium in certain positions. Both apparatuses are put together in accordance with the same principle, which consists in the fact that the arrangement and control of the situation are made both from beneath and from above, instead of only from above, as in the case of the earlier table.

I. Apparatus for the Roentgenological Examination of the Cranium

(Figs. 1 and 3)

The head or the object which is to be radiographed is placed on the object-table on a thin transparent slab of celluloid twice as thick as an ordinary film. This celluloid slab is mounted in a frame so that it can be stretched tight and fixed by screws and be changed easily. Beneath the celluloid slab there is a metal plate with central opening. On this plate are placed the casettes, and thus these can be changed without its being necessary to move the objects under investigation. Under the centre of the celluloid slab there is a mirror, which forms an angle of 45° with a horizontal plane, and in the mirror a hair-cross is engraved. The hair-cross is looked at through a tube in order to get the centre. The object-table can be

Fig. 1.

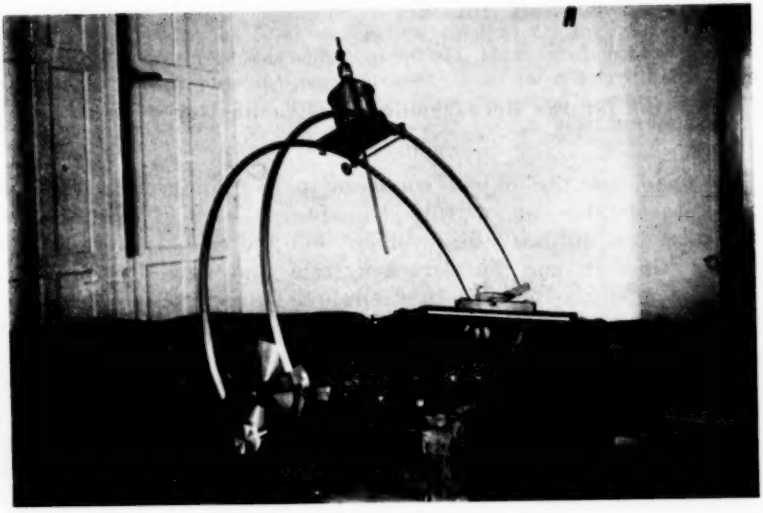

Fig. 2.

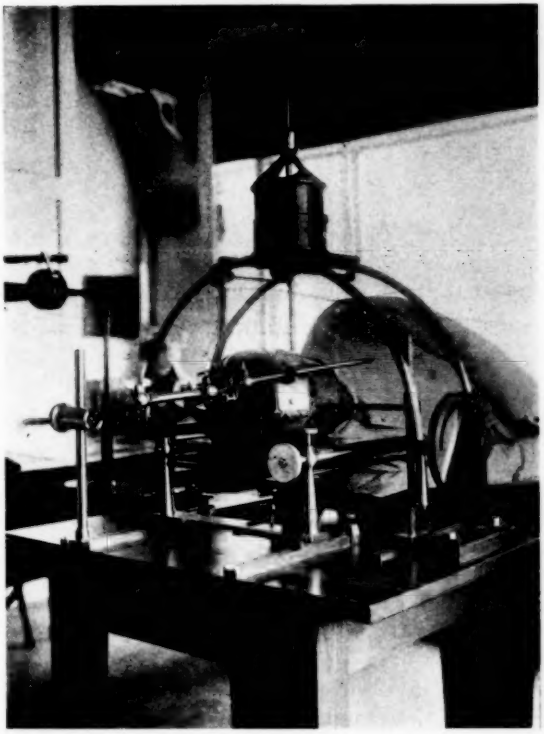

Fig. 3.

moved forwards or backwards in two grooves in the longitudinal direction of the table. Round the object-table there moves a swingable semi-circular graduated metal arc with its centre in the middle of the celluloid slab, which can be fitted and fixed at different angles in the longitudinal direction of the table, on an axis which traverses the celluloid slab. On the metal arc, which is also divided up into degrees there slides the tube-holder, in which there is a removable centering-pin, which can be swung round at a point (corresponding to the focus of the roentgen tube) and which can be locked by means of a screw. Hence when the roentgentube is moved through different angles, by sliding on the arc or by swinging, the central ray retains its direction towards the middle point of the celluloid slab — that is to say, the point which can be seen in the centre of the hair-cross. By the side of the object-table there

are movable graduated index-pegs, which serve to control the positions sideways. For fixing the head there is a fixing arrangement, which can be regulated within wide limits, and by means of which it is possible to fix the object at three points by means of pelottes of rubber-sponge and cork.

The procedure, e. g. in arranging a head, is as follows: first there is marked on the patients head or on that part of the body which is to be radiographed, the point which is to serve as the base point for the central ray. The patient is placed on the table and the head is so placed that the marked point is made to coincide with the hair-cross when one looks through the guide-tube. Then the head is arranged in a fronto-occipital or bitemporal direction, or in the position desired, in such a way that corresponding symmetrical points (e. g. the hearing passages, processus occipitalis-externa the base of the nose) are arranged horizontally through the two side guide-pegs and vertically through the upper centering-peg. In many cases it is sufficient to arrange the object through the hair-cross and the upper centering-peg. The head is now fixed by wedging in the pelottes in the way that is shown in figure 3 and the position is controlled. Then the centering-peg is removed and the roentgen tube is mounted. It is now possible to take pictures at different angles, and it is also easy to take stereoscopic pictures, as the apparatus is graduated in such a way that a movement of 10° corresponds to the distance between the pupils.

This apparatus makes it possible to take pictures with a very small diaphragm and to make a uniform reproduction of arrangemens and symetrical adjustments e. g. the maxillary joints, processus mastoideus, canalis opticus, porus acust. intern., foramen ovale et. cet. by using the angular values found in photographing dry skulls. As examples pictures are shown below of maxillary joints, processus mastoideus, foramen ovale with the use of the angles stated on the pictures. A future memoir will throw detailed light on the diagnostic results that have been obtained by the use of this apparatus.

II. Apparatus for Skeletal and urogenital Investigation

(Fig. 2)

This apparatus differs from the above mainly in its size. The arc has a radius of 65 cm. and can be swung upwards from the table. This gives the advantage that the patient can be lifted on to the table without needing to be drawn through the arc. Other features in the design of the apparatus are shown in the figures.

Fig. 1.

Fig. 2.

Right and left foramen ovale.

Fig. 3.

Fig. 4.

Right and left maxillary joint 3° occipital 5° caudal.

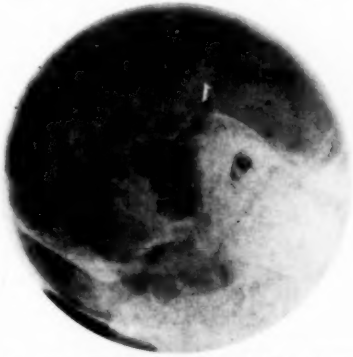

Fig. 5. Proc. mastoideus 20° occipital 15° cranial.

This apparatus can also be fitted with a Potter-Bucky diaphragm, which is placed between the mirror and the celluloid slab and can be rotated round an axis in the centre in such a way that if the roentgen tube is turned obliquely in a given direction the Potter-Bucky diaphragm can be so turned that the lamellae always remains parallel to the direction of the rays. For this purpose, of course, it is necessary to have a plane Potter-Bucky diaphragm e. g. BRADY's.

SUMMARY

The writer describes an arrangement of the installation in which the centering takes place both from above and from below. The apparatus permits of a very exact adjustment and the use of small diaphragms. Symmetrical adjustments ex. porus acust. intern., foramen ovale, for opticum on both sides can be executed with close precision.

ZUSAMMENFASSUNG

Verf. beschreibt eine Einstellungsvorrichtung, bei welcher die Zentrierung sowohl von oben als von unten geschieht. Der apparat ermöglicht eine sehr exakte Einstellung und die Anwendung von sehr kleine Blenden. Symmetrische Einstellungen, z B. von Porus acust. int., Foramen ovale, For. opticum beider Seiten lassen sich sehr präzis ausführen.

RÉSUMÉ

L'auteur décrit un dispositif de mise au point dans lequel le centrage se fait aussi bien par en haut que par en bas. L'appareil permet une mise au point très exacte avec de très petits diaphragmes. On peut également réaliser avec une précision satisfaisante des mises au point symétriques notamment du conduit auditif interne, de la fenêtre ovale, du trou optique de chaque côté.

ERRATUM

Dr. S. A. HEYERDAHL wishes to get the following correction done with regard to his article on »*The Treatment of Surgical Tuberculosis with Carbon Arc-Light Bath*» Acta Radiologica, Vol. IV fasc. 4:

Case 13 (Page 325) has not been healed through arc-light treatment. The author since writing his article has been informed that the patient in 1922 was operated upon because of tubercular gonitis without osseus focus. Resectio genus was performed and the patient has since been well.

NEWS ON THE BOOKSHELF
OF ACTA RADIOLOGICA

L. Arzt & H. Fuhs: Röntgen-Hauttherapie. Publ. Julius Springer, Wien & Berlin 1925.

H. Holfelder, H. Holthusen, O. Jüngling, H. Martius: Ergebnisse der medizinischen Strahlenforschung, Vol. I. Publ. Georg Thieme, Leipzig, 1925.

H. Gocht: Die Röntgen-Literatur. Vol. I. 1918—1921. Publ. Ferdinand Enke, Stuttgart, 1925.

G. Grossmann: Physikalische und technische Grundlagen der Röntgentherapie. Publ. Urban & Schwarzenberg, Berlin, 1925.

I. C. Lehmann: Die Technik der Röntgenaufnahmen, Publ. Fr. Cohen, Bonn, 1925.

F. Blumenthal: Strahlenbehandlung bei Hautkrankheiten, Publ. S. Karger, Berlin, 1925.

I. Seth Hirsch: The Principles and Practise of Roentgen Therapy. Publ. The American X-Ray Publishing Co. New York, 1925.

Carlos Heuser: Tratado sobre Radioterapia superficial y profunda. Publ. E. Spinelli, Buenos Aires 1924.

H. Holfelder: Die Röntgentherapie bei chirurgischen Erkrankungen. Handbuch der Röntgentherapie VIII:1, Publ. W. Klinkhardt, Leipzig, 1925.

H. Meyer: Lehrbuch der Strahlentherapie I. Publ. Urban & Schwarzenberg, Berlin, 1925.

H. Rieder und *J. Rosenthal:* Lehrbuch der Röntgenkunde. Publ. Johan Ambrosius Barth, Leipzig. Vol. I 1924, Vol. II 1925.

R. Grashey: Irrtümer der Röntgendiagnostik und Strahlentherapie. — Irrtümer der allgemeinen Diagnostik und Therapie sowie deren Verhütung, Heft. IV. — Georg Thieme, Leipzig 1924.

Otto Jüngling: Röntgenbehandlung chirurgischer Krankheiten. S. Hirzel, Leipzig 1924.

Alban Köhler: Grenzen des Normalen und Anfänge des Pathologischen im Röntgenbilde. Lucas Gräfe & Sillem, Hamburg 1924.